



57
NUMBER 83

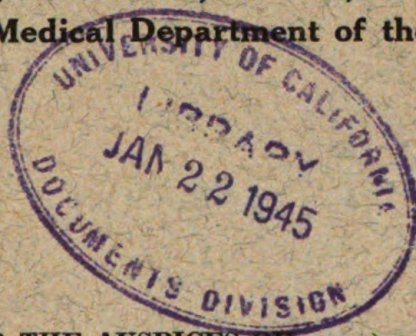
DECEMBER 1944

THE BULLETIN

OF THE

U. S. Army Medical Department

A periodical containing original articles, reviews, news, and abstracts of interest to the Medical Department of the Army



ISSUED UNDER THE AUSPICES OF
THE OFFICE OF THE SURGEON GENERAL

PUBLISHED MONTHLY AT THE MEDICAL FIELD SERVICE SCHOOL
CARLISLE BARRACKS, PENNSYLVANIA

By direction of the Secretary of War, the material contained herein is published as administrative information for the proper transaction of the public business and with the approval of the Director of the Budget.

NORMAN T. KIRK
Major General, U. S. Army,
The Surgeon General.

NUMBER 83

DECEMBER 1944

THE BULLETIN
OF THE
U. S. Army Medical Department

ISSUED MONTHLY

WAR DEPARTMENT
OFFICE OF THE SURGEON GENERAL,
WASHINGTON 25, D. C.

.

THE BULLETIN

OF THE

U. S. Army Medical Department

EDITORIAL STAFF

LIEUTENANT COLONEL JOHNSON F. HAMMOND, M. C., Editor
MR. GEORGE A. SCHEIRER, Managing Editor
MISS HELENA V. KAY, Assistant

EDITORIAL BOARD

MAJOR GENERAL GEORGE F. LULL, U. S. ARMY,
The Deputy Surgeon General, Chairman
MAJOR GENERAL ROBERT H. MILLS, U. S. ARMY,
Consultant in Dentistry
BRIGADIER GENERAL RAYMOND A. KELSER, U. S. ARMY,
Consultant in Veterinary Medicine
BRIGADIER GENERAL HUGH J. MORGAN, U. S. ARMY,
Consultant in Medicine
BRIGADIER GENERAL FRED W. RANKIN, U. S. ARMY,
Consultant in Surgery
BRIGADIER GENERAL JAMES S. SIMMONS, U. S. ARMY,
Consultant in Preventive Medicine
COLONEL ALBERT H. SCHWICHTENBERG, M. C.,
Consultant in Aviation Medicine
COLONEL ESMOND R. LONG, M. C.,
Consultant in Tuberculosis
COLONEL AUGUSTUS THORNDIKE, M. C.,
Consultant in Reconditioning
COLONEL WILLIAM C. MENNINGER, M. C.,
Consultant in Neuropsychiatry

Subscriptions may be placed with the Book Shop, Medical Field Service
School, Carlisle Barracks, Pennsylvania.

Annual subscription: \$2.00; foreign subscription: \$2.50.
Single copies, domestic, 25 cents; foreign, 30 cents.

All other communications relating to this publication should be addressed
to The Surgeon General, U. S. Army, Washington 25, D. C.

Foreword

With the October 1943 issue, The Bulletin became a monthly periodical, instead of a quarterly, dedicated to keeping the personnel of the Medical Department informed on developments in war medicine. The new publication, known as The Bulletin of the U. S. Army Medical Department, absorbed the former quarterly dental and veterinary bulletins and will have material devoted to those fields in each issue.

The Bulletin is intended to be educational rather than directive in nature. It will contain the best information obtainable concerning military medical experience, observations, and procedure that may help to improve further the quality of professional services. The Bulletin will be a medium whereby experience gained in one theater of combat may be shared with those serving in other combat areas and with those in this country who are preparing for overseas duty. News items concerning military and scientific developments as well as original articles will be emphasized. The Bulletin, however, should not serve as a basis for the forwarding of requisitions for equipment or supplies referred to therein.

Obviously, some of the most interesting field experiences cannot be divulged in a periodical of this kind when our country is at war. The Bulletin will, however, publish that which can be safely told, drawing not only on current literature, but on many authoritative reports which reach The Surgeon General's Office from the field. Officers are invited to submit for publication reports of their field experiences that can profitably be shared with other officers.

The Medical Department has been commended for its work in caring for the sick and wounded in theaters of operations in war. The Bulletin will endeavor to stimulate such progress and to advance further the high standard of medical service in the Army of the United States.

Contents

NEWS AND COMMENT

	<i>Page</i>
The Prevention of Scrub Typhus	1
Daily Shipments of Whole Blood to Europe	2
Fixation of Fractures with Metal	3
Sulfadiazine in the Prevention of Respiratory Diseases	5
Infected Chemical Burns of the Eye	8
Failure of Whole Fresh Homografts in Man	9
Educational Program for Convalescent Hospitals	10
The Normal Chain of Evacuation	11
Procaine Cartridges	13
Monthly Medical Meeting	13
Sanitation in the Field	14
The Mound Latrine	15
Wrought Gold Alloy Treatment	15
Venereal Disease Rates Overseas	16
Repair of Rupture of Membranous Urethra	18
Program to Improve the Army Medical Library	19
Commissions for Psychologists	20
Air Evacuation of Casualties	21
Surgery at Field Hospitals	22
Shortage of Nurses	26
Smallpox in Civilians at an Air Field	27
Medical Supplies for Liberated and Occupied Territories	27
Uses for the Army-Navy Plasma Unit	29
Chicago Dental Society	32
Photoroentgen Camera Tube Coupling Device	32
Consultants in Nutrition	34
Food in the Burma Jungles	34
Washing Machine	35
Dental Service on an Army Transport	36
Recent Directives and Publications	37
Award of Soldier's Medal	38
Athletic Contests and the Greek Nation	76
Wounds of the Extremities	79
Medical Museum Seminar	117

SPECIAL ARTICLES

THE CEREBRAL FORM OF MALARIA

Colonel Thomas Fitz-Hugh, Jr., M.C., A. U. S., Major Dickinson S. Pepper, M.C., A. U. S., and Major Henry U. Hopkins, M.C., A. U. S.	39
---	----

SYMPATHETIC OPHTHALMIA

Major M. E. Randolph, M.C., A. U. S.	49
---	----

DISABILITY DISCHARGES	52
-----------------------------	----

PLANT COLLECTING BY THE ARMED SERVICES

Egbert H. Walker, Smithsonian Institution	55
---	----

ORIGINAL ARTICLES

TRENCH FOOT

Major Joseph C. Edwards, M.C., A. U. S., Captain Morris A. Shapiro, M.C., A. U. S., and Captain Jennings B. Ruffin, M.C., A. U. S.	58
---	----

COMPLICATIONS OF PRIMARY ATYPICAL PNEUMONIA

Lieut. Colonel Charles S. Higley, M.C., A. U. S., Major Harry A. Warren, M.C., A. U. S., and Captain Richard S. Harrison, M.C., A. U. S.	67
---	----

FOOTDROP FOLLOWING SKELETAL FIXATION

Captain Emanuel Blumenfeld, M.C., A. U. S.	73
---	----

ADJUSTABLE ACRYLIC MOUTH PROP

Captain Marvin G. Freid, D.C., A. U. S.	77
--	----

INFECTIOUS MONONUCLEOSIS

Captain William H. Walker, M.C., A. U. S.	80
--	----

FIELD WATER SUPPLIES IN TUNISIA

Captain Alvin F. Sellers, V.C., A. U. S., and Major Guy H. Gowen, M.C., A. U. S.	94
--	----

NEUROPSYCHIATRIC OUTPATIENT DEPARTMENT

Captain Nicolai Gioscia, M.C., A. U. S., and Captain Joseph J. Michaels, M.C., A. U. S.	100
---	-----

INJURY TO CEREBRAL CORTEX FOLLOWING ANOXEMIA AND EXSANGUINATION

Major Reynold E. Church, M.C., A. U. S., and Major Lewis H. Loeser, M.C., A. U. S.	104
--	-----

PACK PALSY

Major Barnes Woodhall, M.C., A. U. S.	112
--	-----

ISOLATED OUTBREAKS OF STREPTOCOCCAL SORE THROAT

Captain Owen S. Ogden, M.C., A. U. S.	118
--	-----

CLINICAL NOTES

MALARIA APPEARING AFTER DISCONTINUANCE OF ATABRINE PROPHYLAXIS

Major Robert L. Cavenaugh, M.C., U. S. A.	120
--	-----

AMELOBLASTOMA OF THE MANDIBLE

First Lieut. Henry M. Goldman, D.C., A. U. S.	121
--	-----

Notice to Contributors

Contributions to The Bulletin should be typewritten, double spaced, with wide margins, and in duplicate including the original and one carbon copy. Great accuracy and completeness should be used in all references to literature, including the name of the author, title of article, name of periodical, with volume, page, and number—day of month if weekly—and year. Materials supplied for illustrations, if not original, should be accompanied by reference to the source and a statement as to whether or not reproduction has been authorized. Adequate legends should accompany each illustration in order to point out clearly to the reader the condition or lesion or other objectives, which in some instances should be indicated by a small arrow or other device. Each illustration and table should bear the author's name on the back; photographs should be clear and distinct; drawings should be made in black ink on white paper. Original articles will be accepted for publication on condition that they are contributed solely to The Bulletin and that editorial privilege is granted in preparing the material submitted for publication. Reprints may be ordered for official use. Arrangements for reprints for personal use may be made direct with the Book Shop, Medical Field Service School, Carlisle Barracks, Pennsylvania. The type will be held for two months following publication.

THE PREVENTION OF SCRUB TYPHUS

The prevention of scrub typhus is a problem of increasing importance in the Southwest Pacific and in Southeast Asia. The wearing of clothing impregnated with dimethyl phthalate provides one of the most practicable methods of individual protection against this mite-borne infection. A simple method for the rapid impregnation of clothing with dimethyl phthalate in the field has been developed in the Southwest Pacific by Captain Raymond C. Bushland, Sn.C., of the U.S.A. Typhus Commission. Clothing and blankets are treated by dipping in an emulsion containing 5 percent dimethyl phthalate and 2 percent soap.

To prepare a sufficient quantity of the emulsion to impregnate about one hundred uniforms, first dissolve 6 pounds of G.I. laundry soap (about seven cakes) in 10 gallons of water by boiling; then add 25 gallons of cool water. To 5 gallons of this soap solution add slowly 7½ quarts of dimethyl phthalate, whipping vigorously to make a creamy concentrate. Pour this concentrate into the remaining soap solution to make the finished emulsion, measuring about 37 gallons. An oil drum, G.I. cans, and a G.I. wire egg whip, or suitable improvised mixing device, suffice for preparing the emulsion. Dimethyl phthalate is supplied for clothing impregnation in one-gallon containers and is listed in War Department Circular No. 151, 17 April 1944, as Q.M. Item No. 51-R-300, "Repellent, insect, spray, clothing (dimethyl phthalate)."

To treat the garments, immerse clothing, including shirts and trousers or coveralls, socks (placed in trouser pockets), and/or leggings, in the emulsion. Wring out over a second container to save excess emulsion. The clothing is ready to be worn when dry. Blankets and sleeping nets may also be treated in this manner. Only dry materials should be dipped and the emulsion should be stirred while the garments are being immersed. Garments treated as directed will remain mite-proof during five weeks of occasional wearing or will protect the wearer until laundering is necessary, under ordinary field conditions. Thorough impregnation withstands sun, rain, and excessive sweating but is removed by washing with soap and hot water. Thus, treatment of clothing should be

From the Tropical Disease Control Division, Preventive Medicine Service,
Surgeon General's Office.

repeated after each laundering. For blankets, treatment at two-month intervals is sufficient. Impregnated clothing also affords protection from mosquitoes biting through fabric and repels sandflies, fleas, and, to some extent, ticks for a least a few days. Untreated shorts should be worn under treated uniforms to prevent skin irritation in the groins. No other precautions appear necessary.

This method of mass treatment of clothing with dimethyl phthalate emulsion represents an improvement over application of the undiluted repellent by hand or by spraying. It provides rapid and uniform impregnation of garments without the uncertainty of reliance on the individual application of the repellent. The value of using repellent-impregnated clothing to afford protection of military personnel from mite attack and consequently scrub typhus has been established by both U.S. and allied forces in the Pacific.

DAILY SHIPMENTS OF WHOLE BLOOD TO EUROPE

The increased shipments by air of whole blood direct to Paris reflect the fierce fighting in Europe. The War Department announced on 25 October that 750 pints of whole blood leave the United States daily via the Air Transport Command bound for Paris. Careful preparation and packing at Red Cross donor centers in the United States permit this blood to be rushed to the front lines with very little handling. Blood taken from a donor is placed directly in the quart bottle which is used for the transfusion in Europe. After adding a preservative, the bottles are hermetically sealed and placed in wooden packages, which are given a class 1 air priority. Unloaded from the airplanes in Paris, the blood packages are rushed to the front by air or truck.

Brigadier General Fred W. Rankin, chief consultant in surgery to The Surgeon General, said, "The continued success of the whole blood program should not be construed as indicating a relaxation in the need for blood donations in the blood plasma program. Blood for the preparation of plasma is still needed in large quantities. The whole blood program, however, gives thousands of soldiers a far better chance to live than they have had with blood plasma alone. In cases of severe shock and bleeding, with advanced anemia, and where emergency operation is necessary, whole blood is essential in the preservation of life."

FIXATION OF FRACTURES WITH METAL

Certain precautions should be observed in the use of metal for the internal or external fixation of fractures. Defective design or improper methods of application of metal devices have led to complications such as incomplete fixation, non-union, and infection.

Plates and screws. The standard bone plates and screws at present issued by the Army are all stainless steel. The plates are labeled 18-8 SMO, with a number indicating size and the manufacturer's name. The screws have no marking. Since vitallium was formerly the standard material and depot stocks of this item have only recently been exhausted, many hospitals have both steel and vitallium. Where only steel has been issued, vitallium may have been removed from patients and retained in the operating section, thereby mixing the two metals. It has been observed that some hospitals do not segregate steel and vitallium carefully, and in some instances the two have been used together in fixation of a fracture. The use of dissimilar metals is not good practice and should be avoided since thereby electrolytic reaction is established. In appearance the steel and vitallium plates are similar and have corresponding size designation, but the latter is labeled vitallium while the steel plate is distinctly marked as stated. The screws are easily distinguished since the vitallium screws have a light grey color and dull luster somewhat like that of dull aluminum, whereas steel screws have a bright metallic luster. While tantalum has not been adopted as a standard material for bone screws or plates, it has been used in a few instances and may be identified by its dark grey color and dull luster. Vanadium steel, which had a distinctive blue color and metallic sheen, was declared obsolete a few years ago, and none should be on hand in Army hospitals. Where vanadium is removed from old healed fractures, the tissue and metal reaction is always pronounced. Vitallium, which is an alloy, and tantalum, which is an element, are inert in body tissues. There is so far no standard test on which to base the required strength of various plates. Breakage is not common except in fractures of the femur; however, plates used for fixation of fractures should at least be tested, and if they can be broken or even bent by hand, they should not be used. Breakage of both steel and vitallium screws during convalescence has not been uncommon and may be attributed to use of improper drill size, strain on the fracture site, incomplete fixation, or defective material and workmanship. The drill size must correspond to the size of the screw; if it is too large, the screw will be loose; if it is too small, the insertion of the screw will require increased force and may cause the screw to break.

Recently, a number of standard bone screws were found to be defective since the metal cut to form the flutes had piled

From the Surgical Consultants Division, Surgeon General's Office.

up in the margin of the threads, which were partially blocked. This defect interferes with the thread-cutting quality and, consequently, the holding power of the screws. It is, therefore, advisable carefully to examine all the material used for fixation. In perfect internal fixation of a fracture, the bone should be as strong as normal without danger of physiologic reaction or breakage. The present materials and designs have not permitted the full realization of this ideal. Various agencies are now conducting exhaustive tests on the physiologic and physical qualities of plates and screws of various designs and compositions. The Army has become vitally interested in this investigation, and as soon as it is complete, steps will be taken to adopt the highest standards for future specification.

Pins and wires. Steinmann pins are made of stainless steel and recently the standard pins have been made with an improved cutting point. There were numerous instances of breakage of the pins produced by one manufacturer, but available stock has been tested and breakage should now be infrequent. Pins should not be pounded through dense cortical bone, because this may fracture the bone and is likely to damage the pin. Jointed Steinmann pins in which the two segments screw together in the middle have been declared obsolete and *none* will be used. These pins break easily, sometimes with the retention of fragments in the bone. Pins may be preferred where skeletal traction is to be maintained during transportation or in exceptional cases where skeletal fixation is to be incorporated in a cast, since Kirschner wires always require bows to maintain tension. The latter is the method of choice for skeletal traction in fixed hospitals. Lateral or rotary motion of the pins and wires must be prevented.

Flexible wire. There are available four standard sizes of Wire, corrosion-resisting steel (Med. Dept. Item Nos. 3889000-3891000). If wire is used for the fixation of fractures, it should be strong enough to permit early joint motion where that is desired, as in the patella and olecranon. Several strands of fine wire twisted together may be preferable to a single strand of heavier wire. Wire is available in both steel and tantalum, but where it is used with other types of fixation, similar metals should be used. The strength of wire is often overestimated in fracture treatment and breakage is not an uncommon complication. Because wire fixation lacks stability, it is not recommended for the shaft of long bones.

Bolt. One standard Bolt, tibia (Med. Dept. Item No. 3011500) is available for fixation of fractures. This item has not been entirely satisfactory because of material and construction, but in the future it is to be made of stainless steel (SMO 18-8) with a solid head, complete with two washers and two nuts. This item is useful where compression is desired, and the excess length can be cut with the standard Cutter, wire, surgical (Med. Dept. Item No. 3667900).

Bands. Parham bands cause considerable tissue reaction and, by constricting effect, produce bone necrosis and pain. They are not furnished as a standard item, and their use is not approved.

SULFADIAZINE IN THE PREVENTION OF RESPIRATORY DISEASES

Beginning in the winter of 1942-1943, controlled studies were made in military organizations on the use of small doses of sulfonamides for the prevention of respiratory-transmitted diseases, especially meningococcal infections, streptococcal disease including scarlet fever and streptococcal sore throat, and the large group of infections classified as "common respiratory disease." The studies indicated that sulfadiazine administered to large groups is effective in reducing the incidence of these diseases. On 3 September 1944, a meeting at The Surgeon General's Office was attended by representatives of the Army Epidemiological Board, the Air Surgeon's Office, the Medical Consultants Division and the Preventive Medicine Service of The Surgeon General's Office, and the Bureau of Medicine and Surgery, U. S. Navy, to consider the adoption of a uniform Army policy on the use of sulfadiazine prophylactically.

The work done under the auspices of the Air Surgeon was reviewed. Large-scale use in individuals receiving 1 gram of sulfadiazine daily, at three Air Forces posts, was followed by substantial reductions in hospital and dispensary admissions for respiratory diseases. It was felt that 0.5 gram daily may be nearly as effective, although data are less complete for this dosage schedule. A small number of dermal reactions occurred among 36,000 men given the 1-gram dose for periods of from one to eight weeks. No cases of agranulocytosis occurred and no deaths were attributable to the drug.

The Navy's studies also were reviewed. Six hundred thousand men were given sulfadiazine for varying periods between December 1943 and June 1944 in doses of 0.5 to 1.0 gram daily, and a drop of from 75 to 80 percent in sick-call attendance for respiratory diseases followed. Streptococcal disease was even more sharply curtailed, meningitis was virtually eliminated, and a definite decline in rheumatic fever occurred after a lag of a few weeks. The reactions observed in the Navy's studies were mostly dermal, and they occurred in about 0.5 percent of the personnel receiving the drug. These reactions generally began about the second or third week, and the incidence did not rise after three weeks; 45 severe reactions and several deaths occurred; however, all but two of those who died had been given sulfadiazine therapeutically after the onset of toxic symptoms. A rule was adopted, during the latter part of the study, that no

From the Preventive Medicine Service, Office of The Surgeon General.

medical or dermatological patients who had recently received prophylactic sulfadiazine would be given therapeutic sulfonamides until a definite diagnosis had been made or sulfonamide intoxication had been ruled out. When in doubt, and in cases with known sulfonamide sensitivity, penicillin was used in cases requiring chemotherapy. Among the last 200,000 persons receiving sulfonamide prophylaxis after the adoption of this policy, no deaths occurred. The Navy's experience with respect to dosage was similar to that of the Army Air Forces; 1-gram daily doses were considered probably a little more effective than those of 0.5 gram. The Navy is planning the continuation of its large-scale prophylactic program throughout the coming winter.

The Director of the Commission on Meningococcal Meningitis, Army Epidemiological Board, presented data on the sulfadiazine blood levels to be expected from various dosages of the drug. A mean blood level of 1.55 mg. percent was estimated to result from a daily dose of 0.5 gram, and 2.52 mg. percent from a daily dose of 1.0 gram. It is believed that the 0.5-gram dose will suffice to prevent the development of meningitis.

Possible objections to sulfadiazine prophylaxis were discussed. One is the development of sulfadiazine-resistant strains. No evidence that this may occur from prophylactic doses has been seen, and the danger is less important than it was before penicillin became available. A question was raised concerning the possibility that prophylaxis may merely postpone the occurrence of infections to which unseasoned troops are susceptible. While present information does not wholly answer this question, to those who have done the work, it seemed unlikely that troops who escape respiratory diseases during their first winter would be as susceptible in the following year as newly inducted troops.

After full discussion of the policy to be adopted by the Army, it was generally agreed that the measure should be accepted and recommended by The Surgeon General's Office when definite indications exist. The greatest differences of opinion concerned the indications for adoption of the procedure. The use of incidence rates as criteria for starting prophylaxis was not considered entirely satisfactory, as it gives too little opportunity for the exercise of medical and epidemiological judgment in determining the danger of an increase in the incidence of a disease; however, some objective measure of disease prevalence is needed to prevent abuse of the program and to give medical officers a guide as to when consideration of prophylaxis is warranted.

A decision on how long to continue prophylaxis was not possible at this time beyond saying that it should ordinarily not be continued more than three weeks. Circumstances surrounding a particular outbreak, such as the degree of seasoning of troops at a post, the amount of movement of personnel into and out of the post, the nature of the training program, the season of the year, and the behavior of untreated organizations, must be relied on to a large degree in determining when to discontinue

prophylaxis. That dangers are inherent in the administration of even such small doses of sulfadiazine to large organizations for considerable periods is evident from the studies mentioned. It will be necessary to guard against danger by recognizing early reactions and avoiding the administration of therapeutic or prophylactic doses of sulfonamides to persons known to be sensitive to them.

A War Department technical bulletin, "Sulfadiazine Prophylaxis of Acute Respiratory Diseases,"¹ was issued on 1 November 1944. It is hoped that, during the coming winter, the prevalence of diseases against which prophylaxis is effective will be so low that the measure will seldom need be used; however, chemoprophylaxis offers a promising means of controlling a group of diseases which always have been a serious threat to military groups, especially recently inducted troops. There is ample reason to believe that it will markedly reduce the morbidity and mortality of these diseases, will diminish interference with training programs on account of sickness, and lessen the incidence of crippling sequelae and complications.

1. TB MED 112.



The Army Veterinary Corps inspects all meat purchased for the Army for wholesomeness and contract requirements as to grade and quality. The inspection of boneless beef includes a check of the boning operation. The cuts obtained from a carcass are divided so they will produce 40 percent steaks and roasts, 30 percent stewing and boiling beef, and 30 percent ground beef. Signal Corps photograph

INFECTED CHEMICAL BURNS OF THE EYE

Secondary infection in chemical burns of the eye is a serious complication and increases the amount of permanent scarring of the cornea. Such infections should be prevented if possible. As a prophylactic, all eye burns should be treated with 3 percent sodium sulamyd drops (Med. Dept. Item No. 9120300) three or four times a day as directed in TM 8-285, "Treatment of Casualties from Chemical Agents." However, penicillin sodium solution (Med. Dept. Item No. 1606800), 1,000 units per cubic centimeter, may be substituted for the sodium sulamyd. In the treatment of the established infection, the purulent discharge should be removed by *gentle* irrigation with 1 percent saline solution. Copious irrigation should be avoided, since it tends to remove the loosened epithelium.

For specific therapy, penicillin sodium is the preferred drug and is best used as a solution containing 1,000 units per cubic centimeter in physiologic saline. Three or four drops of this solution should be placed in the eye every one to two hours until the infection has subsided. The frequency of the treatments can then be reduced to three or four times a day.

If penicillin is not available or, after three or four days, if penicillin fails to control the infection, one of the sulfonamides should be used. Ten percent sodium sulamyd solution (Med. Dept. Item No. 9120300) is preferred where frequent treatments are possible. Three or four drops should be placed in the eye every one or two hours until the infection has subsided, after which time treatments may be reduced to three or four times a day. If the treatments cannot be given every one or two hours, sulfathiazole ophthalmic ointment (Med. Dept. Item No. 1464000) may be used every four hours.

In addition to the foregoing specific therapy, it is important that mydriasis be effected by the use of 1 percent atropine sulfate or atropine ophthalmic disks (Med. Dept. Item No. 9116300). Local anesthetics should *not* be used frequently. Their chief use is to enable the physician to make an occasional thorough examination of the eyes.



U. S. Army nurses at station hospital in India, 1942. Signal Corps photograph.

FAILURE OF WHOLE FRESH HOMOGRAFTS IN MAN

With the establishment of the Neurosurgical Section at Walter Reed General Hospital, it was decided to use homografts for the repair of large nerve defects. An abundant source of material existed in adjoining amputation wards. Experimental studies by Huber in the last war, confirmed and extended recently by English investigators, showed that nerve regeneration was possible through homografts to a degree almost equal to that noted in autografts and, indeed, following simple nerve suture.

Eight whole fresh homografts, obtained from amputation stump revisions made at the same time, were placed in extensive nerve defects in seven patients. The engrafted segments measured from 29 mm. to 90 mm. and were inserted after mobilization, transplantation, and joint posturing had failed to close the neural defect. After transection of the proximal and distal nerve stumps through normal appearing fascicles, the homografts were sutured in place with 0.003-inch tantalum wire epineurial sutures. The two anastomotic lines were protected with 0.00025-inch tantalum foil cuffs and in each instance the central portion of the graft remained unprotected. The time interval between grafting and injury ranged from six to fifteen months.

No evidence of clinical regeneration was evident after an average observation time of six months. The grafts were then exposed under local anesthesia and stimulated with a bipolar faradic current. Stimulation studies showed a normal pain response in six grafts at points varying from the proximal suture line to 20 mm. distal to that area, and in two cases, faint sensory responses were obtained in the distal nerve stump. The grafts, including proximal and distal stumps, were removed, fixed in 10 percent formalin, sectioned, and stained with Bodian's protargol method for nerve fibers, counterstained with aniline blue.

Grossly, the nerve ends and graft portions protected by the foil appeared relatively normal, whereas the unprotected segments were ensheathed by constricting adhesions. On longitudinal median section, the fascicular arrangement of the central stump was seen to be interrupted at the proximal suture line, some nerve bundles appearing to end there and others to send fibers into the graft fascicles. In all but the proximal portions of the grafts, there had occurred a fatty fibrous transformation with the remaining fascicles showing necrosis or different stages of fibrosis. The distal suture line was demarcated by junctional fibrosis separating the degenerated graft fascicles from the distal stump fascicles largely made up of Schwann cells.

Prepared by Lieut. Colonel R. G. Spurling, M.C., A.U.S., Captain William Lyons, Sn.C., A.U.S., Captain B. B. Whitcomb, M.C., A.U.S., and Major Barnes Woodhall, M.C., A.U.S., of the Neurosurgical Section, Walter Reed General Hospital, Washington, D.C.

Although the grafts were clinical failures, nerve fibers could be demonstrated in all grafts for distances varying from 5 to 40 mm. This growth, however, failed to mature under the adverse influence of several factors. These factors are summarized in the following description of a specimen: "In all of the fascicles, the orderly arrangement of nerve fibers stops at the junction of the graft and from here distally the fibers become entangled in neuromatous whorls and collagenous tissue. The nerve fascicles of the graft have become overgrown with connective tissue and some contain large numbers of fat-laden macrophages. A few nerve fibers have penetrated about 10 mm. into the graft and end abruptly among macrophages and connective tissue fibers—the old nerve tubules show remaining Schwann cells with fibroblasts and abundant endoneural fibrosis. Between the fascicles are tracts of dense fibrous tissue and adipose deposits. All of these tissues appear well vascularized."

It is apparent from these studies that, contrary to results obtained in animals, whole fresh homografts in man will result in histologic and clinical failure. Although the force behind nerve regeneration is potent and although the grafts become vascularized, nerve regeneration in whole fresh homografts in man is invariably defeated by the more rapidly developing intra- and interfascicular fibrosis.

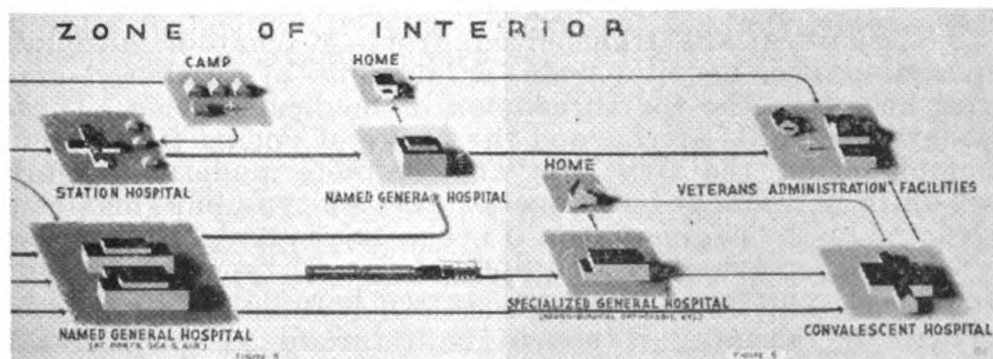
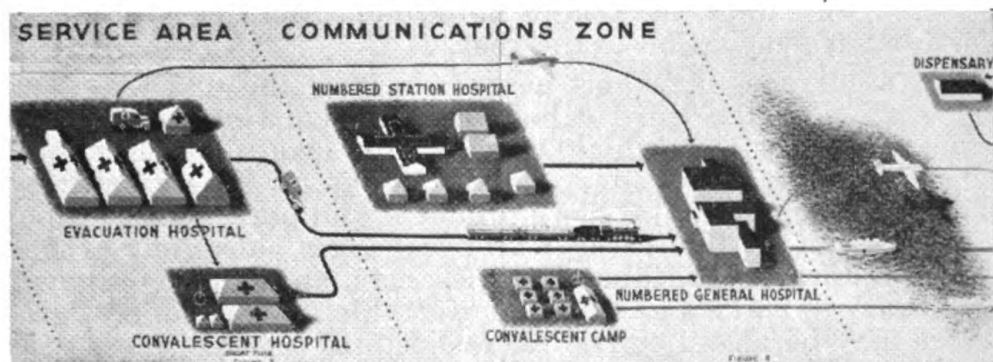
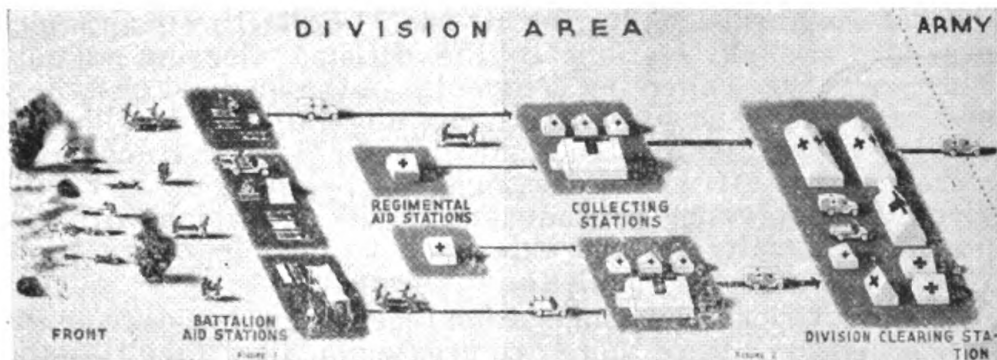
EDUCATIONAL PROGRAM FOR CONVALESCENT HOSPITALS

Approval has been granted for the educational program for convalescent hospitals. Equipment and qualified limited service personnel are to be transferred from A. S. F. Ordnance, Adjutant General, Engineer, and Signal Corps training centers to carry on the educational program of exploratory shop craft for convalescent patients. Courses are to be set up in seven job families, adapting the personnel training programs now in existence in the A.S.T.P. schools but arranged for courses of two weeks or shorter. The job families selected fall into the following groups: (1) business and Army administration, (2) radio, communications, and electricity, (3) graphic arts, (4) agriculture, (5) music, (6) automotive mechanics, and (7) woodworking. Courses will be devoted to the exploration of patients' skill and capacities with interest in certain occupational fields. They are not adapted for the vocational training of technicians for industry.

This program will be established at first in the Welch Convalescent Hospital, Mitchell Convalescent Hospital, Wake-man General and Convalescent Hospital, and Percy Jones General and Convalescent Hospital and will be expanded from these four as rapidly as possible in the remaining designated convalescent hospitals. The reconditioning program in these convalescent hospitals will include physical reconditioning and occupational therapy.

THE NORMAL CHAIN OF EVACUATION

The mission of the Medical Department is to keep the soldier well and able to fight and, if he becomes wounded or sick, to move him back and get him well as soon as possible. To accomplish this, the Medical Department has evolved the "Chain of Evacuation," the key to which is the system of "echelonment" in which each echelon is a link. The following diagrammatic illustrations are in no way intended to portray detailed accuracy in equipment.



The first echelon of service is furnished by the attached medical personnel of units, which consists usually of company aid men, litter bearers, and an aid station squad in which is found the commissioned personnel of the detachment.

The company aid man renders the first emergency treatment for the soldier where he finds him and then directs or carries him to the battalion aid station in a protected area which may be 300 to 500 yards behind the fighting line. Here the soldier is given emergency medical care under the supervision of a medical officer, his emergency medical tag is started, and, if he cannot be returned to duty, he is prepared for immediate movement to the rear.

The second echelon, which takes over when the man leaves the aid station, generally includes all of the remaining service furnished by the division. Collecting companies evacuate the aid stations to the division clearing station. There are three collecting companies in the medical battalion, and each may evacuate two or more aid stations. A collecting station is generally located a mile or so behind the front and is merely a stop-off where dressings can be checked, morphine given, or emergency procedures carried out which will prepare the casualty for the ride back to the clearing station, which is usually 4 to 7 miles on to the rear.

The divisional clearing station receives casualties from the entire division. Here there are greater medical facilities and more medical officers. If the man can be returned to duty within a few days, he is kept here, but if not, he is prepared for further evacuation to the rear.

Ambulances transport casualties from the division clearing station to the third echelon of medical service, i. e., an evacuation hospital which is generally several miles behind the division rear boundary, out of range of enemy artillery. The evacuation hospital has equipment and personnel qualified to carry out difficult surgical procedures, also nurses and x-ray, laboratory, bathing facilities, cots, and other equipment necessary to make a casualty comfortable. In this general area there may be also a convalescent hospital to which casualties can be sent from the evacuation hospital if they can be returned to duty within a short time.

Casualties are transported from evacuation hospitals by ambulance, hospital train, or airplane to numbered general hospitals, the fourth echelon of medical service. These general hospitals are beyond the range of enemy fire, except bombing from the air. They are complete modern hospitals set up in permanent buildings, or barrack-type buildings constructed by the engineers, or, if necessary, in tents. Here there are time, personnel, and equipment for all types of medical service. Even reconditioning is started here.

If the casualty is not to be returned to duty in the theater, he is started on his way to the fifth echelon of medical service, the named general hospitals back home in the zone of the interior, where all possible procedures are carried out to return the soldier to military duty or to rehabilitate and recondition him for civil usefulness in civil life.

Although not in the normal chain of evacuation, the veterans' hospital may be, in a way, considered a military hospital, since it provides medical care for the soldier after he has been discharged from military service.

In all areas where military personnel are stationed, the Army establishes "station hospitals." These hospitals may be in permanent buildings taken over from our allies or from the enemy, or in temporary buildings constructed by the engineers, or in tents. They may be large or small, depending on the number of troops served. Such hospitals evacuate directly to general hospitals and are not in the chain of evacuation of combat troops.

In all areas from the division to the rear, the Army usually establishes centers for convalescence, reconditioning, and rest, and these may be in the form of a convalescent hospital, a rest camp, or a reassignment center.

PROCAINE CARTRIDGES

In response to an item in the October *Bulletin*, page 24, entitled "Discarded Procaine Cartridges," Major Roger D. Reid, Sn.C., reports that discarded procaine cartridges (Med. Dept. Item No. 1383500) have been used for two years in the Station Hospital laboratory at Fort George G. Meade, Maryland, for the purposes indicated in the item. In addition, this officer writes, the cartridges save much glass tubing when they are used for (1) pipettes for bacteriologic and chemical procedures, (2) filling hematocrit tubes for sedimentation rate determinations, (3) capillary pipettes for clotting time determinations, (4) for the making of T tubes, and other purposes for which small pieces of glass tubing can be used.

The empty cartridges are used also in test tubes in which hypodermic needles are sterilized. The hub of the needle rests on the upper end of the empty cartridge and prevents dulling the point. It saves cotton and has advantages over cotton used for a similar purpose.

MONTHLY MEDICAL MEETING

At the monthly medical meeting, Army Medical Center, Washington, D. C., 19 October, Major General Norman T. Kirk, The Surgeon General, introduced the following speakers: Colonel Benjamin N. Baker, M.C., consultant in medicine, Southwest Pacific Theater, whose subject was "Medical Activities in the Bougainville Operations"; Colonel Luther R. Moore, of the Alaskan Department, who spoke on his experiences as department surgeon. The addresses were followed by a motion picture on thoracic surgery in Russia presented by Dr. Robert L. Leslie, representing the American-Soviet Medical Society.

SANITATION IN THE FIELD

Illustrations showing developments in sanitation which have been used in field installations. They are not to be construed as necessarily coinciding with U. S. Army doctrine. Beginning in the upper left corner and reading from left to right, they show: (1) A latrine constructed to be over water at low tide. There must be a strong ebb tide to carry the refuse out to sea. (2) The mound latrine, a development of the present war, for areas subjected to high water tables. (3) An improvised inclined plane incinerator, one of various types using a petroleum product as a source of fuel. (4) An efficient can crusher made of scrap metal. (5) A garbage pit, 10 feet deep, dug by a bulldozer. (6) Screened shelters for deep pit latrines for areas where supplies and the tactical situation permit. (7) This soldier's back was burned when he threw his cigarette butt into the adjacent hole in a pit latrine which had been sprayed with gasoline.



From the Education Branch, Sanitation and Hygiene Division, Preventive Medicine Service, Surgeon General's Office.

THE MOUND LATRINE

A mound latrine is composed of the standard latrine box, a deep pit, and flyproofing. The pit is in an earthen mound to permit a deeper shaft where high ground waters prevail. Construct a mound with a top 6 by 12 feet (minimum) for a standard four-seat latrine box, and of sufficient height to permit the required depth of pit, allowing 1 foot from base of pit to ground water. The area to be mounded should first be scarified or plowed. The mound should be built up in layers not over 1 foot deep and each layer thoroughly compacted before the next layer is added. Where the ground is dry, each layer should be sprinkled to obtain coherence of soil particles and to aid in compaction. The size of the mound's base should depend on the characteristics of the soil, but a relatively flat slope is preferable. It will be necessary to extend the tamped area 2 feet down the slope in order to get 4 feet of oiled burlap from the pit's edge. Where longer or wider pits are used, the mound must be correspondingly larger. Revetment or interior bracing may be necessary to prevent caving. The closure of the mound-type latrine will be the same as for the deep-pit latrine. The advice of the soils engineer and the use of engineer equipment, such as bulldozers, will greatly expedite the work.

WROUGHT GOLD ALLOY TREATMENT*

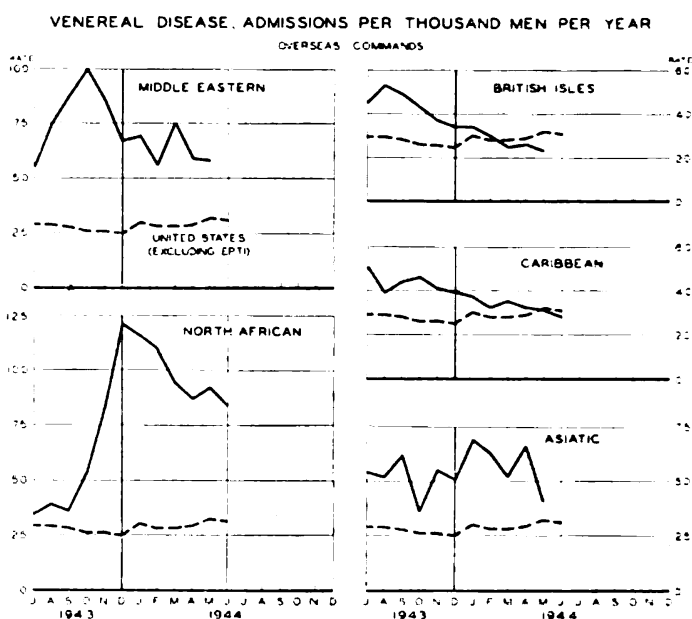
Wrought gold alloys are being procured in the annealed or softened condition to facilitate manipulation without annealing prior to use. After these wrought gold alloys have been formed and the clasps or metal framework for a denture have been completed, it is necessary to heat-treat or harden the piece so the formed metal parts will have the maximum ability to retain or return to their original shape during the stresses of mastication. On some alloys an improvement of as much as 60 percent is possible by careful heat-treatment, which is accomplished by several methods, the most common being to heat the material and permit it to cool slowly. Gold alloys of different manufacture do not contain the same percentage of metallic elements so the temperatures to which they should be heated in the hardening process to obtain the best physical properties vary; however, if gold alloys are heated to 850° F. (about 450° C.) in an electric furnace and then permitted to cool in the oven for thirty minutes, their physical properties will be improved. For those installations that do not have a pyrometer on the electric furnace, this temperature can be attained by placing the formed alloys in a small Kerr electric furnace (Med. Dept. No. 5327805): turn the switch to "medium" for twenty-five minutes; then turn to "off" and allow the part to cool in the oven for thirty minutes. In those dental facilities where no electric furnace is available, heat the part to a cherry red and allow it to cool slowly.

*From the Dental Division of The Surgeon General's Office.

VENEREAL DISEASE RATES OVERSEAS

The venereal disease rate overseas reached a peak of 50 per 1,000 strength per year during December 1943, under the influence of an abnormally high incidence of infection in North Africa concomitant with invasion of Italy. Chiefly because of improvement in the North African situation and, to a lesser extent, in the Southwest Pacific, the British Isles, and the Caribbean, the overseas rate slowly declined to about 35 per 1,000 men per year for May. The recent strength increases in overseas theaters have produced some general lowering of the total rate. North Africa, with its high rate, now has a smaller proportion of the total overseas strength, and the European Theater, with its lower rate, has a larger proportion than before.

Difficulties of control were encountered at first on the Italian peninsula, but since March 1944 some improvement has occurred in the prevention of venereal disease, presumably because of a concerted attack which the theater directed toward this major problem. Since April, however, the rate has been relatively constant at about 85 to 90 admissions per 1,000 men per year, which suggests that further improvement under the present program may be difficult.



In the Middle East and the Persian Gulf Command, which are combined in the accompanying charts, venereal disease admission rates have been consistently higher than average rates for all troops overseas, but the small strength of the area permits wide fluctuation. The troops of the Persian Gulf Command present the main problem. The mission of this command—the maintenance of extensive transportation routes—has made for policing difficulties and has hindered the realization of completely satisfactory discipline.

The Caribbean area continues to make progress in controlling venereal disease, the incidence presenting a downward

trend. The most striking results have been obtained in the Panama Canal Department where the incidence is now roughly comparable to that in the United States. Native troops in the Puerto Rican Sector still have a high rate of infection, reflecting the high degree of infection among the civilian population. Control measures have been somewhat impeded by native superstitions about the necessity for sexual contact in maintaining good health and about the effect of prophylactics on potency, but the program is gaining ground.

In the Southwest Pacific the average admission rates declined further throughout the early months of 1944. The problem there is confined to certain parts of the Australian mainland, especially the Sydney area, where, it has been estimated, perhaps half of all new cases are contracted by men on leave or furlough. Newly provided leave ships for the transportation of soldiers to and from advanced bases have presented an excellent means of implementing the control program. Vigorous prosecution of control measures doubtless explains in large part why the rate of infection remains so low.

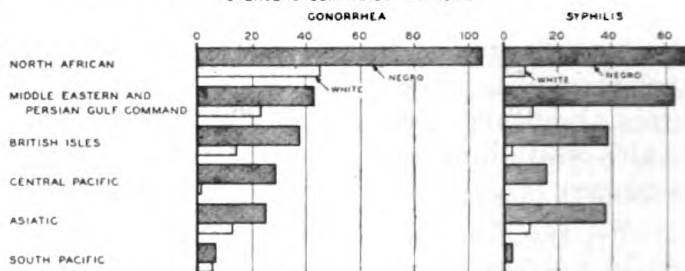
The brothels of Calcutta, Bombay, and Karachi provide the major sources of infection in the Asiatic theater. The troops are widely scattered and recreational facilities are said to be inadequate, but both the Red Cross and Special Services have obtained additional equipment with which to intensify entertainment and recreational programs at isolated stations. Special efforts are being made to encourage the use of prophylactics. Excessive alcoholism has also been singled out for attack by means of education and enforcement of superior discipline.

The progressively favorable downward trend of venereal disease incidence in the British Isles has continued through May, when a rate of 23 was reported, lower than that for the United States. Epidemiological analysis of the problem in the British Isles has aided in the formulation of a realistic and effective control program. Prophylactic materials are items of free issue, for example. Army nurses have proved highly valuable in locating infected contracts and in placing them under treatment, and their example is said to have stimulated civilian health authorities to institute or expand programs for finding sources of infection. The situation in France is potentially dangerous, comparable in many ways to that encountered in Italy. Preliminary reports on the initial experience in Normandy indicate that all towns are off limits to troops and that very little infection was acquired in the early weeks. Special efforts have been made to forestall the development of the analogue of the Italian experience.

Recent changes in reporting make it possible to show venereal disease rates by color for overseas theaters. The reported data for May are summarized in the chart below,

which separate gonorrhea and syphilis. No color breakdown is yet available for the Southwest Pacific. Latin America is a special problem from the standpoint of color classification and is also omitted from the comparison. The other venereal diseases, notably chancroid, are not included in the charts. Chancroid is especially prevalent among U. S. troops in North Africa, the Middle East, and the Asiatic theater.

GONORRHEA AND SYPHILIS, ADMISSIONS PER 1000 MEN PER YEAR
OVERSEAS COMMANDS MAY 1944



REPAIR OF RUPTURE OF MEMBRANOUS URETHRA

The following procedure has been proposed¹ for repair of complete rupture of the membranous urethra:

Through a midline suprapubic incision, the prevesical space is exposed, extravasated blood or urine evacuated, and cystostomy performed at the vertex of the bladder. The prostate is then identified and freed sufficiently anteriorly and laterally so that it can be turned forward on its base. A soft rubber or preferably a Foley bag catheter is passed through the anterior urethra, the tip of the catheter being picked up in the depth of the wound as it emerges through the triangular ligament. The catheter is then threaded through the prostatic urethra into the bladder. The procedure thus far described has been carried out previously, using traction on the Foley bag catheter to draw the prostate into position.

Major Leadbetter proposes passing two sutures of heavy silk through the substance of the prostate on either side of the urethra. The four ends of these sutures are threaded to long straight cutting needles passed through the triangular ligament and through the perineal tissues beneath the pubic ramus to come out through the perineal skin just behind the perineal-scrotal juncture. When traction is applied and the sutures are tied over a rubber tube the prostate is drawn into its normal position behind the symphysis pubis superior to the urogenital diaphragm. The prevesical space should be drained adequately and the wound closed.

This procedure fixes the prostate in normal position, the urethral catheter acting as a guide in approximating the torn ends of the membranous urethra. Repair of the ruptured urethra through the perineum cannot always be done at the optimum time, which is immediately after injury, because of complicating fractures and back injuries.

1. Article by Major W. F. Leadbetter, M.C., of the 33d General Hospital, submitted through The Surgeon General's Office to the Journal of Urology, Johns Hopkins Hospital, Baltimore, Md.

PROGRAM TO IMPROVE THE ARMY MEDICAL LIBRARY

A comprehensive program for the improvement and reorganization of the Army Medical Library is under way. Some parts of the program will require a number of years to fully accomplish, but other parts have already been put in effect. Having been housed in the same building for fifty-six years, having followed the same outmoded cataloging system for a similar period, and having been starved financially for many years, the Army Medical Library now, in the words of its director, Colonel Harold W. Jones, is emerging from its long sleep and attempting to organize for the immediate future as the greatest research medical library in the world.

Recently a thorough survey of the library, covering many weeks of work, was made by a committee appointed by the American Library Association and under the chairmanship of Mr. Keyes D. Metcalf, director of the library of Harvard University. The report of this survey provides a complete view of the innermost parts of this great old library, revealing overcrowded shelves, boxes of valuable books in basements and hallways, thousands of books in need of binding, and a depleted staff sadly in need of more trained personnel. The survey committee reported to Major General Norman T. Kirk, The Surgeon General, that a new building for the library is an absolute necessity, that satisfactory cataloging of books has never been in effect and a change is necessary here because of the tremendous growth of the collection, and that as far as adequate modern classification is concerned, to all intents and purposes, there is none. The surveyors recommended that the administrative head of the library be given the title of director, and that has been accomplished with the appointment of Colonel Jones; that the director should have as chief assistant a civilian career librarian who would serve as head of the technical library administration and provide a continuity that has been lacking because of the short terms of Army officers who have been in charge. The surveyors reported that work in the library should be organized divisionally and this has already been done. The six divisions are acquisition, administrative, catalog, index-catalog, rare books, and reference and circulation.

While a new medical library building was authorized by Congress before war was declared, the necessary funds have not been appropriated. Plans for the new building have been made and approved, and the site on Capitol Hill near the Library of Congress has been selected but not purchased. Plans for cooperation and coordination with the Library of Congress have been made. With the changes in organization mentioned, the Army Medical Library has already become a coordinated unit and will be ready to move its main library, the branch library in Cleveland, and its Washington annex into a new building the moment it is provided.

To further revivify the Army Medical Library, a group of seventy-five honorary consultants, able professional men and women, has been appointed, and their first general meeting was held in Washington on 5 and 6 October, when the findings and recommendations of the survey committee were reviewed, the program of reorganization discussed, and the plans for a new building to house the library and the Army Medical Museum described by the architect. The first day's meeting was held in the old library building; the second day's meeting at the Library of Congress. Among the speakers were Major General George F. Lull, the Deputy Surgeon General; Colonel Harold W. Jones; Mr. Archibald MacLeish, the Librarian of Congress; Mr. Otto R. Eggers, the architect; Lieut. Colonel Balduin Lucké, M.C., assistant director of the Army Medical Museum; and Lieut. Francis R. St. John, acting librarian. The dinner meeting was presided over by Dr. O. H. Perry Pepper, a consultant, and professor of medicine, University of Pennsylvania. The speakers were Dr. Morris Fishbein, editor of the *Journal of the American Medical Association*, and Dr. Reginald Fitz, lecturer on the history of medicine, Harvard University. The consultants elected as their first president, Dr. John F. Fulton, professor of physiology, Yale University Medical School; Dr. Chauncey D. Leake, dean, University of Texas Medical School, vice-president; Colonel Harold W. Jones, secretary-treasurer; and as members of the executive committee, Dr. Clyde L. Cummer, Cleveland, Dr. Wilburt Davison, dean of Duke University Medical School, Dr. Morris Fishbein, and Dr. Henry R. Viets, librarian of the Boston Medical Library. An unusual feature of the meeting of consultants was the presence of four former Surgeons General: Major Generals Merritte W. Ireland, Charles R. Reynolds, Robert U. Patterson, and James C. Magee.

COMMISSIONS FOR PSYCHOLOGISTS

The War Department announced on 10 October that enlisted men qualified by education and experience as clinical psychologists may apply for direct appointment as second lieutenants. Opportunities for appointment are open to those considered best qualified. Clinical psychology was defined as psychological work involving direct contact with individuals or investigation of individual behavior, such as psychological testing, mental hygiene work, counseling, guidance, assembling and analyzing case histories, college psychology teaching, or care of the mentally or physically handicapped. Minimum education requirements are a bachelor's degree in psychology, sociology, or educational or industrial psychology. Applications will be forwarded through immediate commanding officers to the Officer Procurement Division of the service command.

AIR EVACUATION OF CASUALTIES

At the graduation exercises for flight nurses and enlisted technicians of the A.A.F. School of Air Evacuation, Bowman Field, Louisville, Kentucky, on 3 October, Major General David N. W. Grant, the Air Surgeon, said that C-54's of the Air Transport Command are now flying combat casualties home to the United States at the rate of 4,000 a month. (This school was moved to Randolph Field, Texas, on 15 October, and made a division of the A.A.F. School of Aviation Medicine.) Since air evacuation training began at Bowman Field in October 1942, twenty-nine medical air evacuation squadrons have been organized and nearly 1,000 flight nurses and a comparable number of surgical technicians have been trained. Since Pearl Harbor, more than 425,000 sick and wounded patients of the United States and allied forces have been evacuated by air, the vast majority under care of flight nurses. The Ferrying Command of A.T.C. and the Troop Carrier Command are now flying more than 6,000 patients a month from American ports of debarkation to Army hospitals in the interior. This includes a portion of the casualties arriving by sea as well as those coming in by air.



U. S. Army flight nurses on a Coast Guard-manned transport bound for Asia. They will fly back with casualties needing care in American hospitals. Coast Guard photograph.

SURGERY AT FIELD HOSPITALS

The platoons of field hospitals re-enforced the division clearing companies and did invaluable work. They were strengthened by surgical teams from auxiliary surgical groups and their role was to handle the nontransportable cases sent to them by the clearing company. Their chief problems were chests, abdomens, and fractured femurs and badly shocked patients with multiple wounds.

Abdominal injuries. Their routine was to close all abdomens where there had been injuries to the small gut only, when those injuries had been dealt with. All cases of perforation of the large gut had colostomies done. They made routine use of dusting powder of penicillin and sulfanilamide in the proportion of 20,000 units of penicillin to 3 grams of sulfanilamide. The amount used depended on size of wound but did not exceed 40,000 units of penicillin and 6 grams of sulfanilamide. All abdominals had gastric suction for first few days until the danger of paralytic ileus had passed. Abdominal cases were not evacuated for seven to ten days except in case of dire necessity. Whenever this principle was violated, most unsatisfactory results ensued. In some cases where extensive resections had been done, a Miller-Abbott tube was inserted. The dictum of the consultant surgeon to British forces in Normandy was, "It is better to stitch up ten perforations than to resect ten inches of gut."

Chest wounds. Sucking chest wounds were dealt with at the earliest possible moment and temporary closure obtained with occlusive dressings. A number of cases were brought in with hemoptysis and dyspnea associated with blast and no apparent external damage. When patients were distressed by pressure, pneumothorax was relieved by a large bone needle in the interspace with tube to a water seal. Hemothoraces were dealt with by repeated aspirations and kept as "dry" as possible. This reduced the likelihood of sepsis and reduced the necessity for thoracotomy later. Where aspiration of a hemothorax was done, 20,000 to 30,000 units of penicillin in saline solution were injected to partially replace it.

Fractured femurs were put up in plaster casts for transportation, usually a one and one-half spica to costal margin by U. S. units and in the Tobruk splint in British units. The importance of adequate padding under the distal fragment of a fracture of lower third was stressed. These fragments frequently damage the femoral or popliteal artery and this almost invariably causes gangrene of the limb. When putting limbs in spicas, it is most important to remember that they will have to travel on a litter in ambulance, plane, ship, or train,

These brief impressions recently gathered in France from surgeons operating at field hospitals and their counterpart, the field dressing stations with British units, and from evacuation hospitals and their counterpart, the British casualty clearing stations, are from Colonel T. S. Gillespie's Circular Letter of 23 September 1944. Colonel Gillespie is the British medical liaison officer stationed at the Medical Field Service School, Carlisle Barracks.

and if the plaster is too wide it frequently means a great deal of trouble and may necessitate the patient's being left behind. If a crossbar is put from one limb to the other, it should be put on lower aspect to allow easy use of a urinal.

Large wounds of soft parts were frequently immobilized in plaster. Both field hospitals and evacuation hospitals stressed the importance of having as many technicians as possible trained in plaster work. Casts were padded and split and description of the injury was written on them.

Transfusions. About 80 percent of the patients handled at field hospital platoons required whole blood. The amounts given of course varied with the patient but an average amount appeared to be 3 to 4 pints, of which 2 to 3 were whole blood. Some surgeons gave much larger amounts, but the experience of those who have done a great deal of transfusion work shows that very large amounts are frequently followed by anuria. Primary transfusions are not usually followed by reactions. The consulting surgeon in the British sector stated that in badly exsanguinated patients 3 to 4 pints of blood were often given, followed by an equal amount of plasma. Many surgeons complained of the size of the needle supplied and stated that blood did not run freely. Cases which do not show a response to transfusion within an hour should not be delayed further; they need surgery, not transfusion.

Anesthetics. Endotracheal ether and oxygen or gas and oxygen was the anesthetic of choice for abdomens and chests. Pentothal was used for most other operations. A few routine appendectomies were done under spinal but this anesthetic is unsuitable for shocked cases. Infiltration anesthesia and nerve blocks were used for extremities and badly shocked patients. This helped the anesthetist, as the surgeon did this himself.

Collecting Company Group

These groups re-enforced collecting companies which were in need of help and seemed to be on hand to handle any emergency which might arise in the Army area. Two jobs which come to mind were the evacuation of about 2,000 German wounded from a hospital in Cherbourg to the evacuation beach in twenty-four hours. Another was the escorting by the commanding officer of six German nurses through the lines under a white flag and handing them over to German authorities. Its general function is to work with evacuation hospitals, to clear their casualties to the beach with its ambulances, and to clear division clearing company's casualties to evacuation hospitals.

The Evacuation Hospital

Both 400-bed and 750-bed hospitals were working in Normandy and they were certainly doing a splendid job. One of them handled over 1,000 cases in the first six days of the invasion. In the early stages all lightly wounded and quite a

number of more seriously wounded, who were considered fit to travel, were evacuated by air; but later when things were more settled the evacuation hospitals kept cases longer and did a great deal of surgery. They were re-enforced by the surgical teams of the auxiliary surgical group. One unit did a twelve-hour night spell of sixty-one operations, but they found that with eight tables going it was rarely possible to handle more than 90 to 100 patients in a twenty-four-hour period. Some hospitals worked eight-hour shifts and others preferred twelve-hour shifts, which were easier to handle from a rest and feeding point of view. It is questionable if the standard of surgery can be kept up for twelve-hour shifts.

X-rays. A great deal of x-ray work was done to exclude presence of foreign bodies in thorax or abdomen. More technicians were required. X-ray became rather a bottleneck. Rapid drying of films presented a problem which was dealt with in one unit by arranging an improvised drying rack opposite the warm exhaust of a light generating plant.

Surgery in evacuation hospitals. Routine handling of soft part wounds was a thorough débridement, removing all dead tissue but an absolute minimum of skin—not more than 1 to 2 millimeters. Wounds were dusted with standard penicillin-sulfanilamide powder (20,000 units and 3 grams) till the wound had a frosted appearance. An insufflator, if available, would be ideal for this purpose. The wound was then dressed with petrolatum gauze. Tight packing must be avoided. Post-operative penicillin and sulfathiazole were used as for abdominals where needed. If wound of limb is extensive, the limb should be immobilized in plaster for transportation, always remembering to put a note on the plaster of what has been done. Documents and emergency medical tags sometimes do not arrive with the patient; plaster casts almost invariably do. The importance is reiterated of arranging hip spicas so they will not be too broad for the litter and also the importance of putting the crosspiece below rather than above to allow for use of urinal. Limb plasters should always be split and padded. The splitting should include all layers of dressing. For hip spicas, pads of felt should be placed over sacrum and anterior superior iliac spine and a pad shaped like a Maltese cross over patella.

Primary suture. It seems hardly possible that anyone should still be ignorant of the danger of primary suture of wounds before evacuation but a few still exist who did it.

Secondary suture. Getting wounds ready for this or grafting is the main object of treatment. A great many wounds have secondary suture done in three to seven days, and results have been most satisfactory and hospitalization time greatly reduced.

Gas gangrene was not nearly so prevalent as was expected. The combination of good early surgery, sulfonamides, and penicillin was responsible for this but, of the three, the best is good early surgery. Surgeons fresh to a war theater are prone to amputate too readily in cases of gas gangrene. A great many cases will clear up with excision of muscle groups, free drainage, transfusion, and the administration of penicillin, anti-gas-gangrene serum, and sulfonamides. Amputation should never be performed in a doubtful case without a consultation with a more experienced colleague.

Ligature of femoral or popliteal artery has been previously almost invariably followed by gangrene. A very recent report on some cases where this procedure had been carried out and where "decompression" had been done by a division of the fascia through a long posterolateral incision from knee to ankle stated that results had been very promising and were better than injection of the sympathetic. This procedure is now being adopted as a routine. A ligature should not be performed in early stages of an arteriovenous fistula of popliteal. Every possible chance should be given for the collateral circulation to develop.



Operating in a portable hospital in New Guinea, 4 February 1943.

SHORTAGE OF NURSES

There is a critical shortage of nurses in the Army. The response to the call for 10,000 additional nurses who must be recruited within the next few months has been disappointing.

Major General Norman T. Kirk, The Surgeon General, said on 11 October that the Medical Department had expected to recruit at least 4,000 nurses during September but that only 500 nurses had applied for commissions. There are now 209,000 civilian nurses, exclusive of 112,000 student nurses, in the United States. "Surely," General Kirk said, "there are 10,000 graduate, registered nurses who are willing to join the Army to help out in this emergency." Army nurses now number about 40,000. Because of the ever-growing demand for them to care for casualties overseas, the number in the United States has been reduced to about 13,000, of whom almost 4,000 are assigned to the Air Forces.

Many Army hospitals in this country already are using nurses' aides, senior cadet nurses who cannot yet qualify as registered nurses, and WACs who are relieving enlisted men on hospital wards. Nurses, however, are needed to supervise these nonprofessional workers. The need for more nurses is heightened by the fact that the Medical Department will be required to activate in November, and ship overseas, hospitals it had not expected to organize before next March. This is due, General Kirk said, to the activity on all three war fronts and the ever-increasing number of casualties.



Unloading patients at a portable surgical hospital six miles back of front lines in the China-Burma-India Area.

SMALLPOX IN CIVILIANS AT AN AIR FIELD

From the Latin American theater comes a report of a civilian smallpox epidemic with serious potentialities. A civilian employee of an A.A.F. base unit was reported to command headquarters on 24 August. On the following day, four additional cases were discovered, and by 27 August seven cases had been found. An investigation disclosed that the seven cases lived in two areas near the field and that many other cases had developed in civilians who had not been working for the Army. An epidemiologist was sent to the airport on the day the first case was reported. He visited the patients and found that none of them had ever been vaccinated.

The first control measure consisted of revaccinating the 178 permanent military personnel on the post; 571 civilian employees, both American and native, were also vaccinated. All transients coming in contact with personnel of the base were ordered vaccinated. Navy installations and the health authorities of the country were notified of the outbreak. All stations in the theater were informed by radio that transient personnel and those on temporary duty at this base during the period from 16 to 25 August were exposed to smallpox and immediate vaccination was recommended. The types of reactions resulting from vaccination of military personnel were rather surprising. Of 155 vaccinations, 75 resulted in vaccinia, 9 in vaccinoid reactions, and 39 in immune reactions. Although, in view of the urgency, some outdated vaccine with an expiration date 25 December 1943 was used, there were only twelve failures to "take."

The recommendations of the epidemiologist were: (1) Vaccination of all newly hired civilians. (2) Reactions to vaccination should be closely checked, with readings at three days and again at nine days; if no take is obtained, personnel should be revaccinated. (3) Military personnel in this theater should be revaccinated every year. No known secondary cases or foci have occurred. This is gratifying in view of the possible dissemination of smallpox by persons infected at one point and traveling by air to other countries.

MEDICAL SUPPLIES FOR LIBERATED AND OCCUPIED TERRITORIES

The Surgeon General appointed a board of officers, in June 1943, to prepare, develop, and implement the medical portion of the War Department's program for aid to civilian populations in liberated countries. The board has made extensive studies of the medical, sanitary, and veterinary requirements for liberated and occupied areas of Europe and the Far East.

The use of these supplies in areas which have been liberated or occupied for a period of more than one year indicates that the estimate of requirements has been satisfactory. The quantity and variety of medical supplies furnished liberated areas are those considered essential to meet the basic needs of the area. In arriving at the quantity of items to be furnished, careful

consideration has been given to the known prewar status of medical care, the estimated depletion of supplies, and the destruction in each area for which supplies are to be provided. The policy is to provide supplies for relief and prevention of disease and unrest rather than for rehabilitation.

Medical, sanitary, and veterinary items are shipped in unit assemblies according to the use for which they are planned. Operating personnel is not provided. In each unit assembly, sufficient supplies are included to care for a certain fraction of the population. Following are the lists of supplies which have been developed for and are being used in areas of Europe. Similar lists which have been altered to meet the special needs of the Far East are also in use.

Basic Medical Unit. This assembly contains basic drugs, dressings, surgical instruments and accessories, and confinement supplies for expectant mothers.

Hospital Units contain complete equipment for hospitals of 200- and 40-bed capacities. No cover is provided since the use of existing buildings is anticipated.

Supplemental Tropical Unit contains drugs for the treatment of tropical diseases.

Obstetrical Bag. This unit consists of hand portable kits containing basic obstetrical supplies for the use of trained midwives.

X-ray Supply Unit contains expendable x-ray supplies for use with existing x-ray equipment.

Basic Laboratory Unit consists of laboratory equipment and supplies for use in epidemic studies and laboratory diagnosis of diseases.

Biological Reserve consists of a central reserve of biologicals to be used as required for the control of epidemics.

Tracheotomy Set. This unit is for use in the event of diphtheria epidemics.

Malarial Survey Laboratory Unit is for performing malarial surveys in tropical and subtropical countries.

Sanitation Equipment Unit consists mainly of water-purification equipment to furnish an emergency supply of potable water until such time as existing utilities can be repaired.

Sanitation Supply Unit contains water purification supplies for use in connection with the Sanitation Equipment Unit.

Antityphus Unit. This assembly was developed by the U. S. A. Typhus Commission and is for use in the prevention and control of typhus outbreaks.

Antimalarial Equipment Unit contains sprayers and accessory equipment for malaria control.

Antimalarial Supply Unit contains insecticide, repellent, and oil for use with the Antimalarial Equipment Unit.

Basic Veterinary Unit. This assembly contains basic essential drugs and dressings for the prevention and treatment of animal diseases.

Veterinary Surgical Unit contains basic instruments for the surgical treatment of animals.

Veterinary Laboratory Unit consists of laboratory equipment and supplies for the diagnosis of diseases of animals and for the testing of foods of animal origin.

Veterinary Biological Unit. This assembly contains vaccines, serums, and diagnostics for the prevention and treatment of epidemic-type animal diseases.

USES FOR THE ARMY-NAVY PLASMA UNIT

The plasma set, salvaged by units using them in the field, can be put to various practical purposes. Medical officers returning from combat areas have called attention to the adaptations of this salvaged equipment illustrated on the following pages.

I. The most common use of the plasma set is to administer reconstituted, dried, human plasma. Shown also in an improvised plasma bottle holder for suspension of bottle from the roof of a field ambulance. (*The Bulletin*, September 1944, page 30)

II. This drawing shows the collection and administration of whole blood in the forward combat area by the indirect "open method." (See S.G.O. Circular Letter No. 108, 27 May 1943.)

III. An efficient continuous or intermittent gastric suction apparatus can be improvised from the plasma set.

IV. A simple and efficient tidal drainage apparatus.

V. Miscellaneous uses for the various parts of a plasma set are shown here. An apparatus can be set up to irrigate wounds or it can be used to keep dressings wet with a minimum of nursing care. The tubing works well as a nasal catheter for the administration of oxygen, or as a tourniquet. It can be used as a drainage tube, such as a suprapubic drainage tube, and the receptacle is an empty plasma bottle.

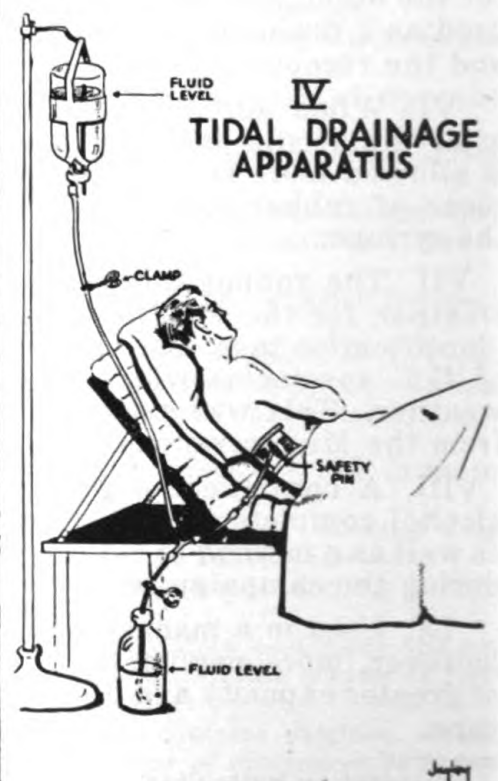
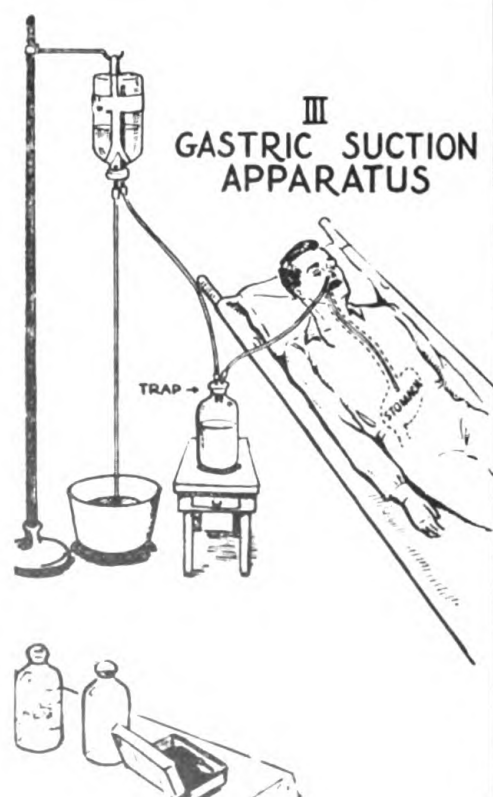
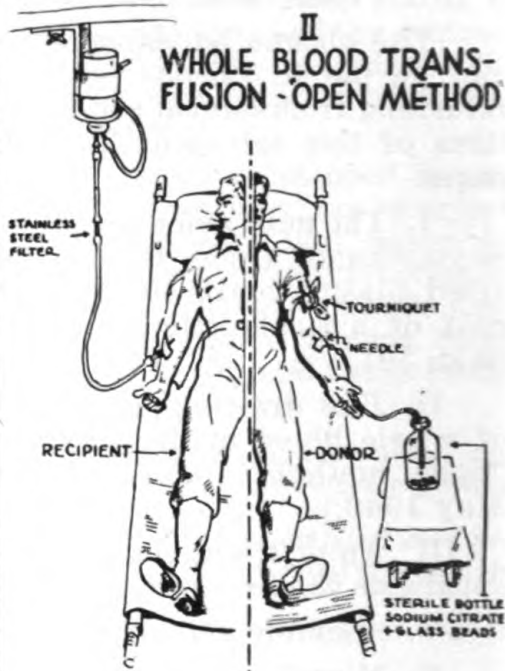
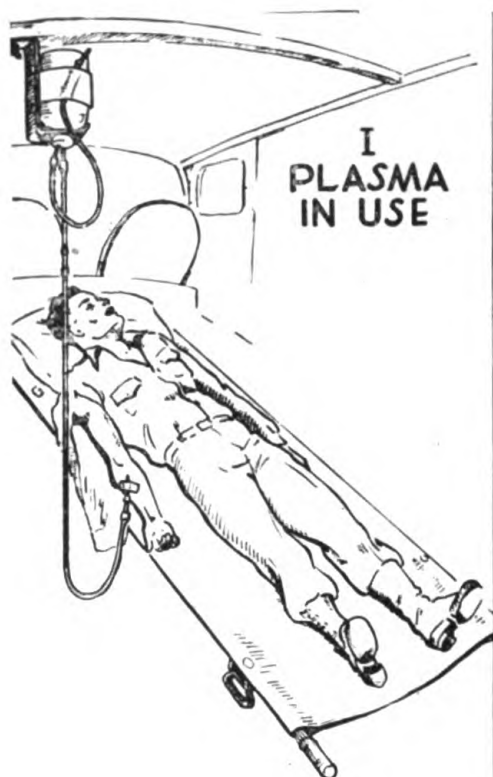
VI. When administering pentothal sodium to a casualty, after the needle has been inserted into a vein, the anesthetist is allowed more freedom of action if the glass adapter and a piece of rubber tubing are inserted between the needle and the syringe.

VII. The rubber tubing makes a convenient cover in cold weather for the metal chain required to subtend a soldier's identification tags, also a covering for the metal temple pieces of G.I. spectacles which often cause skin irritation in hot weather. This was suggested by a medical officer returned from the Mediterranean area.

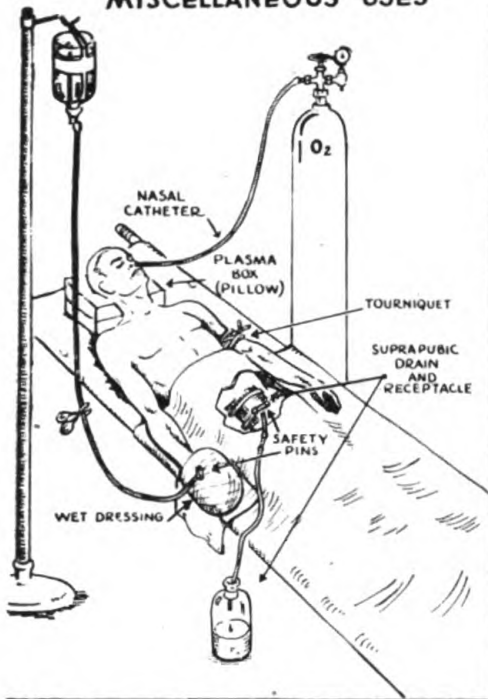
VIII. A convenient improvised field dispenser for soap or alcohol complete with foot-controlled, flow-regulating device as well as a method of flooring a tent used by a medical officer during the campaign on Kiska.

IX. Used in a manner similar to the stove of a "C" ration; however, more popular in North African Campaign because of greater capacity and did not necessitate smoking up canteen cups.

Prepared by Major Charles H. Wilson, M.C., director, Department of Field Medicine and Surgery, Medical Field Service School, Carlisle Barracks, Pa.



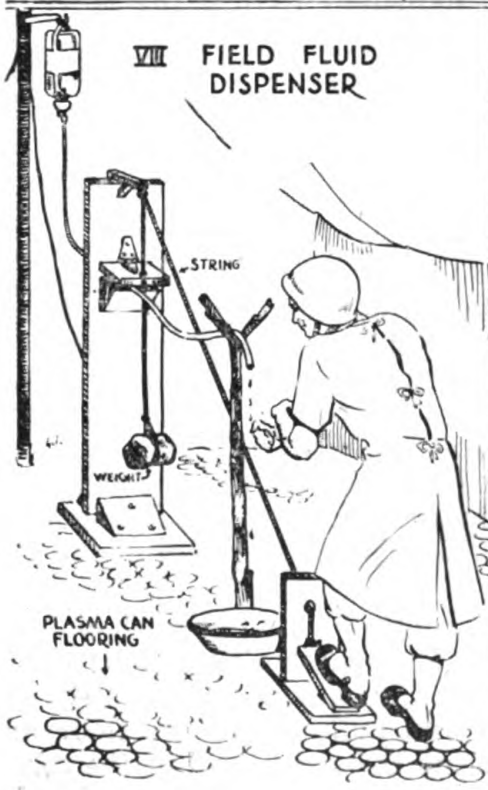
V MISCELLANEOUS USES



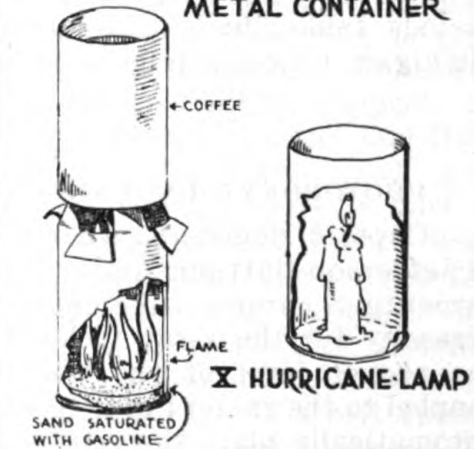
II AID TO PENTOTHAL ADMINISTRATION



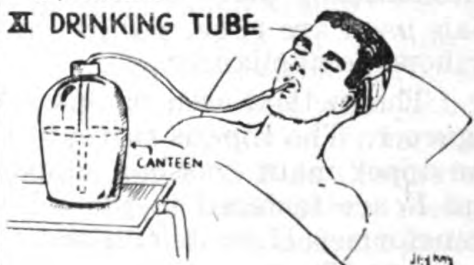
VII FIELD FLUID DISPENSER



IX FIELD STOVE METAL CONTAINER



XI DRINKING TUBE



X. With various modifications this hurricane lamp was used as a tent light in Alaska.

XI. A drinking tube to obviate need for raising serious casualties from litter to give them a drink during evacuation.

Other uses for the plasma set not shown in the drawings are: (1) The improvisation of an emergency suction apparatus. (2) Bottles are used as sterile receptacles for various solutions including large quantities of morphine sulfate solution freshly prepared in anticipation of a large number of battle casualties. They were used extensively by the engineers in the Southwest Pacific as containers for a "Molotov cocktail." (3) The metal containers make an efficient waterproof container for drugs or other small items during amphibious operations by replacing the caps and holding them in place with adhesive tape. (4) The pasteboard containers are in constant demand, by all troops, to use in shipping items home. (5) The needles are a handy supplement to normal issue.

CHICAGO DENTAL SOCIETY

The 81st Midwinter Meeting of the Chicago Dental Society will be held from 12 to 15 February 1945 at the Stevens Hotel. As in previous years the meeting will consist of practical essays, limited attendance clinics, question-and-answer periods, table clinics, and exhibits. Dr. George W. Hax, 8 South Michigan, Chicago, is general chairman of the meeting.

PHOTOROENTGEN CAMERA TUBE COUPLING DEVICE

Captain Eugene E. Ahern, M.C., and Sergeant John Currie, at Jefferson Barracks Induction Station, have developed a photoroentgen camera tube coupling device which eliminates the necessity for the x-ray technician to set the tube each time to the proper level of the photoroentgen camera. The tube is coupled to the camera unit so that its movement up or down will automatically place the tube in the proper position. The materials used are rope, pulleys, and weights usually employed in orthopedic appliances.

The method used in this synchronized coupling is shown in figure 1. The rope is fastened to the camera unit by tying it to the upper main crossbar support on the camera. Pulleys *A*, *B*, and *E* are fastened to the ceiling and pulley *C* to the floor or transformer, if located adjacent to the horizontal rail of the tube support. The rope is passed through pulleys *A* and *B* overhead, through *C* below, and then brought up and tied to a convenient

connection *D*, on the sliding tube support which is initially set in the proper position relative to the camera. The connection *D* can be the knob already located near the stereo shift setting or an improvised hook. From this same point or one adjacent, another rope is run through the overhead pulley *E*, and down to suspend a 5- to 7-pound counterweight used to absorb the recoil tendency of the tube support when the stereo shift is tripped. The tube support is, of course, left free to slide up and down on the upright rod.

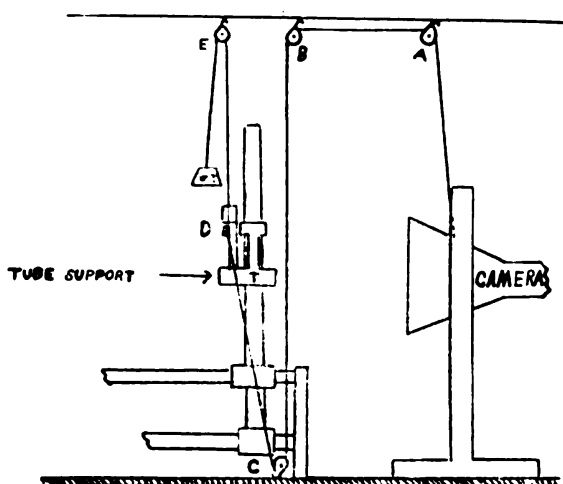


FIGURE 1

Because of the sliding freedom of the tube support, the cocking of the stereo shift now causes excessive unnecessary movement of the tube down and then up into place again, as the counterweight is too light to contest the cocking spring. To overcome this, a lever was developed out of two pieces of hollow electrical conduit pipe, $\frac{5}{8}$ inch in diameter. These were used as *A* and *B* in figure 2. *A* is about 18 inches long and is flattened for about 6 inches from the fixed end at *C*. A hole is drilled into the x-ray machine part, labeled *C*, and threaded. The flattened end of part *A* is then fixed to the machine with a screw to allow motion. This piece will have to be slightly bent to curve about the tube support. At

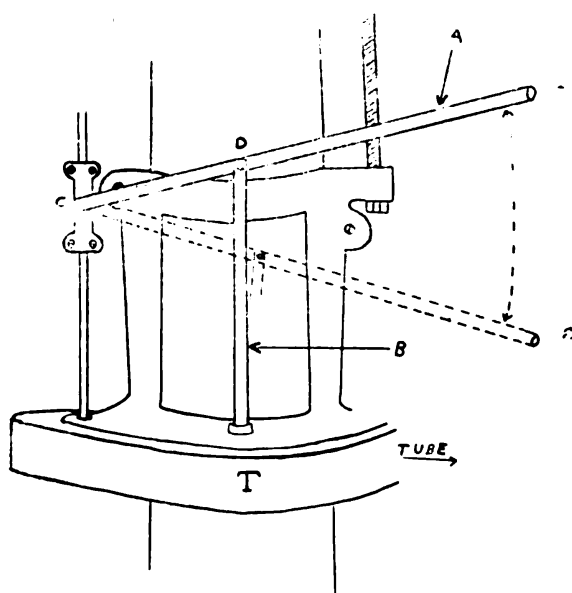


FIGURE 2

about $4\frac{1}{2}$ inches (*D*) from its fixed end, part *A* is bolted loosely to part *B* which is 12 inches long, and, not being flattened, is grooved in the upper end to receive the flattened portion of *A*. At the lower end of *B* is a soft rubber cap which impinges on the tube stand *T*, forcing it into the cocked stereo position when the handle (*A*) is moved from position 1 to 2 as illustrated. After the stereo mechanism is tripped, the handle automatically returns to position 1 again.

CONSULTANTS IN NUTRITION

The following experts in nutrition have been appointed consultants to The Surgeon General of the U. S. Army:

Dr. Otto A. Bessey, chief of the Division of Nutrition and Physiology, Public Health Research Institute, New York City.

Dr. E. V. McCollum, research professor of biochemistry, School of Hygiene and Public Health, Johns Hopkins University, Baltimore, Maryland.

Dr. Julian M. Ruffin, associate professor of medicine, Duke University, Durham, North Carolina.

Dr. Frederick J. Stare, associate professor of nutrition, School of Public Health, Harvard University, Boston, Massachusetts.

Dr. Harold C. Stuart, assistant professor of pediatrics and child hygiene, Harvard Medical School and School of Public Health, Harvard University, Boston, Massachusetts.

Dr. Virgil P. Sydenstricker, professor of medicine, University of Georgia, Augusta, Georgia; consultant in nutrition, Office of Scientific Research and Development.

FOOD IN THE BURMA JUNGLES*

Wild honey is plentiful in the Burma jungles and it is safe to use. There are times of the year in Yunnan, China, when a poisonous flower is in bloom and the Chinese will not use any kind of honey, but in Burma it is used throughout the year.

The common honeybee is found in all the jungle areas. The honey is best in April and May and can be gathered in a bamboo joint and kept indefinitely. The method used to cut a bee tree is to burn an old cloth with a bit of tobacco wrapped inside, in order to stun the bees.

The great tree bees are found on limbs of banyan, kapok, and mango trees and on high rocky cliffs. The comb, which is sometimes 1½ feet thick and 4 feet long, hangs from the limb for several feet. These dangerous bees will attack in masses and follow one for a long distance. The natives take the honey by tying some dried, split bamboo on the end of a long pole, setting it afire, and approaching the comb. If the bees start gathering toward the top of the comb, they are likely to attack, and the attempt is given up rather than to risk the consequences. The honey is best cooked, as too much of it in the raw state is said to make one giddy. One comb will sometimes yield several gallons. These bees are plentiful but often are in inaccessible places.

The bush bees form a comb on small twigs on low bushes. The comb is about 2 inches thick and 8 inches to a foot long. The comb may often be seen hanging in a bush; from a distance it looks like an old, black hat or rag. The bees are not vicious and the honey can be taken without the use of fire or smoke. Throwing a garment over the comb will cause all the bees to leave. The honey made by this kind of bee is claimed to be the purest of all wild honey and can be eaten freely.

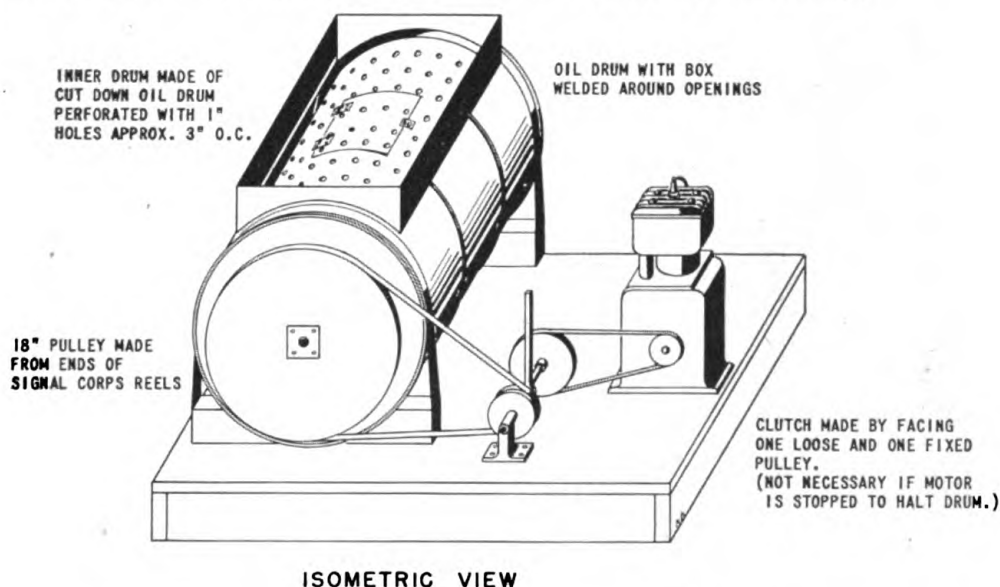
The termite bee is a very small, black bee which lives

*Extract from special report, Office of War Information.

only in the ground, most frequently in the white ant or termite hills. They are harmless, but it is better to keep the head covered while digging for the comb, as the bees will light on the hair and plaster it with a black-colored wax. They are easy to find, many of the large ant hills having one or more holes. The honey of this bee is very sweet but is better boiled.

WASHING MACHINE

As requested, the surgeon of an engineer aviation battalion¹ in the Southwest Pacific Area submitted a description and illustration of an improvised washing machine which proved efficient in that organization. Two standard-sized oil drums were used, one inside the other. The inner drum was cut down to 22 in. in diameter and 32 in. in length. A hinged door was cut on the side and holes $\frac{1}{2}$ in. in diameter drilled at 4 in. intervals over the entire surface of the inner drum. Four wooden cleats 2 by 2 in. were bolted longitudinally on the inside of the inner drum to serve as agitators. On each end of this drum, a flange end shaft was secured with four bolts which could be removed when the inner drum was taken out of the machine for cleaning.



The outer drum has an opening on the side large enough to admit the inner drum. On each end of the outer drum a bearing end is bolted to support the inner drum. One flared end shaft extends through the bearing end far enough to have fastened to it a pulley or sprocket for the driver.

The transmission and clutch were made by facing one loose and one fixed pulley, the size of which is calculated to give the inner drum forty revolutions per minute.

A full barracks bag of clothes can be washed in fifteen minutes in this machine with 20 gallons of hot, soapy water.

1. Captain Meier Mahru, M.C.

DENTAL SERVICE ON AN ARMY TRANSPORT

A dental surgeon on an Army transport reports that for some 7,000 persons aboard on the outbound voyage three dental officers from a general hospital unit were assigned to the dental clinic, and schedules were arranged to enable a large number to have dental attention. Some broken dentures were repaired. Two patients hospitalized with abscessed teeth had, at the end of the voyage, completely recovered.

On the inbound voyage with about 1,400 patients, Lockheed civilians and Air Forces personnel, a great deal of dental attention was given in order to prevent their spending their leave in a dental office. Two dental officers from hospital ship platoons were assigned to the dental clinic on the inbound voyage. A dental officer of the day roster was maintained at all times and the clinic was operating for thirteen hours every day. The field chair, now in use on this hospital ship, was unsatisfactory as it tipped over easily in rough weather.



As a wounded Marine is hoisted to a transport off Eniwetok Atoll, a Coast Guardsman reaches out from the rail to swing the litter over the side. Coast Guard photograph.

RECENT DIRECTIVES AND PUBLICATIONS

This list is intended as only a brief reference to the items mentioned. Before acting on any of them, the original communication should be read. Request for copies, when made, should be directed to the source of the communication through proper channels.

JAG Legal Bulletin
15 July 44

Taxes. Public Law 415, 78th Congress, 3 July 1944, amends sect. 514, Soldiers' and Sailors' Civil Relief Act of 1940 (54 Stat. 1179), insofar as it relates to taxation of personal property of military personnel by any state, territory, possession, or by the District of Columbia. Provides that personal property (other than property used in trade or business) of military personnel which is located in a state in which the owner is not a resident or is not domiciled shall not, for taxation purposes, be deemed to be located or present in or to have a situs in such state, territory, possession, or district.

WD Circular No. 321
3 Aug. 44
Sect. II

No medicinal agent will be administered to patients under care of Medical Department unless it has met one of the following conditions: (1) inclusion in A.S.F. Medical Supply Catalog; (2) inclusion in U. S. Pharmacopoeia; (3) acceptance by Council on Pharmacy and Chemistry of A.M.A.; (4) acceptance by Council on Dental Therapeutics of A.D.A.; (5) specific approval of S.G. or proper theater surgeon.

ASF, Headquarters
Circular No. 258
11 Aug. 44
Part Two, Sect. III

Petroleum Product. Stocks of petroleum products on hand at posts, camps, and stations will be held to forty-five days' supply, except for certain seasonable items. Chiefs of technical services to take immediate action to effect distribution at Class IV installations and will report to the Office of The Quartermaster General excess stocks that cannot be redistributed.

ASF, Headquarters
Circular No. 265
17 Aug. 44
Part Three, Sect. VI

Field Operation. Information received by technical service concerning all phases of operations in theaters in which A.S.F. has an interest, particularly those pertaining to supplies, equipment, and logistics, is to be reported immediately to Director of Intelligence, A.S.F. Prior to departure for temporary duties in theaters, A.S.F. officers will report to Director of Intelligence for briefing.

ASF, Headquarters
Circular No. 270
22 Aug. 44
Part Two, Sect. VI

Certain motion picture films will be distributed weekly for exhibition to convalescent troops in all general hospitals in U. S. Films to be reviewed as to content by the Office of The Surgeon General prior to distribution. Purpose of films is to show convalescent troops the continuing activities in the theater from which they have returned and to keep them informed of activities in all theaters. Commanding officers of hospitals to request the commanding general of the service command for authority to establish a film library and to provide necessary equipment. Commanding officers of hospitals to complete attached questionnaire and forward to Chief Signal Officer, The Pentagon, Attention: Chief, Army Pictorial Service.

WD Circular No. 338
18 Aug. 44
Sect. V

Vermin Control. Lists certain items for insect, rodent, and vermin control that will be stored and issued by officers providing Q.M. supplies.

AWARD OF SOLDIER'S MEDAL

The War Department has announced the award of the Soldier's Medal to the following Medical Department personnel:

MAJOR DANIEL H. MAUNZ, M. C., Bradford Pennsylvania: On receipt of information at an Army Air Forces installation at Presque Isle, Maine, that a civilian cook with a detachment was seriously ill with acute appendicitis at River Clyde, Northwest Territory, Canada, and that no doctor was available, he tendered his services in a professional capacity. Since it was impossible to land a plane safely in the vicinity of River Clyde, he volunteered to make a parachute jump, although he had no previous experience, in order to reach his patient. On 18 November 1943, the rescue plane reached River Clyde. He exited at 1,200 feet, landed successfully, and performed an operation which undoubtedly saved the patient's life.

MAJOR AARON PUSHKIN, M. C., of West Hempstead, N. Y.: On 8 February 1944 near Auburntown, Tennessee, an Army truck overturned in a ditch by the roadside, pinning ten soldiers under it. There was great danger that the water flowing through the ditch would cause the vehicle to sink into the mud and kill all of them. Voluntarily and at the risk of his life he crawled under the truck, administered morphine to a number of the men, and assisted in their removal.

PRIVATE JOHN J. JANOWSKI, JR., posthumous: On 23 March 1944, during a training demonstration a soldier fell into the raging torrent of an icy mountain river in Blackwater Canyon near Davis, West Virginia. An officer had just lost his life in attempting rescue. Private Janowski, with utter disregard for his own safety, lost his life in attempting to rescue the soldier from the turbulent waters.

PRIVATE FIRST CLASS ANTHONY J. KARATH, JR., of Detroit, Michigan: At Aitape, New Guinea, on 23 April 1944, when a landing craft hit a deep hole as it came in to shore, it jarred violently and a soldier was thrown overboard into the hole. The soldier, weighted down with full field equipment, sank at once. Private Karath jumped into the water, grasped the soldier, and after considerable struggle succeeded in bringing him ashore. His courageous action and quick thinking undoubtedly saved the soldier's life.

PRIVATE FIRST CLASS WILLIAM F. MARKS, of Siloam Springs, Arkansas: Although antitank mines and ammunition ignited by aerial bombardment the morning of 20 February 1944, in Italy, were exploding on burning trucks 20 yards away and although several enemy artillery shells landed within 15 yards of him, he rendered first aid to three wounded men and then assisted one of the wounded infantrymen to a position of safety.

PRIVATE ROBERT H. MOORE, of Springfield, South Dakota. For heroism at Cape Sudest, New Guinea, on 2 January 1944.

PRIVATE FIRST CLASS CHARLES F. PICKLE, of Enterprise, Oregon: On 26 February 1944 he was one of the first to reach the scene of an airplane accident and led a group of soldiers in rescuing a pilot and a cadet from an airplane which was on routine training flight from Marana Army Air Field and crashed and burst into flames near Cortaro Side Camp, Cortaro, Arizona. With complete disregard for his own safety he assisted in lifting the left wing of the plane which had been bent back over the cowlings, and in rescuing the pilot from the rear cockpit, and then led in the effort to remove the cadet from the forward cockpit. With great persistence he was able to free the legs and feet of the cadet, cut his safety belt, and assisted in removing him through the side of the plane, notwithstanding the intense heat and extreme danger of the gas tank in the wing exploding. While making this rescue he suffered head burns and burns on both hands.

The Cerebral Form of Malaria

COLONEL THOMAS FITZ-HUGH, JR.

Medical Corps, Army of the United States

MAJOR DICKINSON S. PEPPER

Medical Corps, Army of the United States

and

MAJOR HENRY U. HOPKINS

Medical Corps, Army of the United States

This United States Army general hospital is in an area in India in which malaria is highly endemic. The major preoccupation of its medical service has been the care of a large number of patients suffering from malaria, which in our Army in this theater carries, under modern methods of treatment, a low mortality. Only two deaths have occurred in more than 2,000 American patients during the first seven months of operation (0.1 percent mortality from malaria). All but a very few of these patients have been returned to duty after eight to ten days of hospitalization.¹

The present report summarizes clinical and statistical data from the study and treatment of the first 140 cases of cerebral malaria encountered during the six months ending 1 October 1943. These cases constitute 2.3 percent of the total series of 6,059 cases of malaria. Group A comprised American officers, enlisted men (a little more than one-half of whom were Negro soldiers), and a few women—Army nurses, American Red Cross workers, Medical Department therapists, hospital dietitians. Group B comprised officers and soldiers of an allied nation.

Aside from racial differences, the two groups present contrasts germane to the subject. Group A is composed of carefully selected individuals whose training makes them alert to early symptoms of infection, whose nutritional status is excellent, and whose health has not been impaired by repeated attacks of malaria and other infestations. Group B is composed of men whose selection on scientific grounds of physical fitness has of necessity been impossible; most of them have suffered repeated attacks of malaria and many of them harbor intestinal parasites. The company medical supervision of group A is much more adequate than that of group B. These differences, it is believed, form the basis for the higher mortality of group B.

1. During the earlier period of adherence to the quinine-atabrine-plasmochin standard routine the patients were kept in the hospital for fifteen days. The more recent regimen of atabrine or quinine-atabrine permits of discharge in seven days or less.

TABLE I
Total incidence of malaria in six-months period

Group A (American)				Group B (soldiers of allied nations)			
Type	No.	Percent	Deaths	Type	No.	Percent	Deaths
<i>P. falciparum</i>	571	32.3	2	<i>P. falciparum</i>	2,065	48.2	32
<i>P. vivax</i>	602	34.1	0	<i>P. vivax</i>	773	18.0	0
<i>P. malariae</i>	21	1.2	0	<i>P. malariae</i>	33	.7	0
Mixed species	5	.3	0	Mixed species	23	.5	1
Undetermined	450	25.6	0	Undetermined	766	17.8	4
Clinical only	115	6.5	0	Clinical only	635	14.8	1
Total	1,764*		2	Total	4,295		38

"Type undetermined" designates patients in whose blood trophozoites were found but could not be designated as to type. "Clinical only" designates patients in whom the diagnosis of malaria was made on good clinical and therapeutic evidence despite one or more negative blood examinations. The "mixed" infections in each instance include *P. falciparum*. We have evidence to prove that mixed infections in this area are much more common than these figures would indicate. We have also good grounds for believing that the majority of the "type undetermined" and "clinical only" groups are actually *P. falciparum* infections.

*This figure includes 193 instances of recurrence or reinfection incurred in this theater (rate 10.1 percent).

Cerebral malaria is chiefly a result of *P. falciparum* infection. It is important, therefore, to re-emphasize the statement that *falciparum* (estivo-autumnal, malignant tertian) malaria is truly a protean disease. Even within the category of cerebral malaria there are many and varying manifestations. We have come to use such terms as the "Fighting Type," the "Decerebrate Type," the "Spastic Type," the "Flaccid Type," the "Shocked Type," the "Meningitic Type," the "Encephalitic" or "Bulbar Type," and the "Dopey Type," but the picture changes so rapidly and there is so much overlapping that these attempts at classification are of little value. Indeed, the diagnosis of the cerebral form of malaria in contradistinction to simple severe malaria is occasionally a matter of the personal bias of the observer. This fact is bound to affect statistics on the incidence and mortality of this not too well-defined entity. Trained observers would disagree when confronted by a full-blown classical case of cerebral malaria; however, in the earlier stages and in the less florid forms of the syndrome, there might well be, and are, differences of opinion as to classification.

The cerebral phenomena resulting from plugging of the capillaries by plasmodia, pigment-laden leukocytes, and erythrocytes vary from minimal to the most violent. Cortical irritation, subcortical, brain stem, basal ganglia, frontal lobe, parietal lobe, cerebellar, and hypophyseal syndromes may be observed, with or without the phenomena of generalized cerebral edema. The

pathologic physiology is believed to result from localized or disseminated capillary obstruction, with anoxia followed by localized or generalized edema, neighborhood small vessel spasm, and, in advanced cases, by anoxic necrosis. We have been impressed by the paucity of perivascular cellular infiltrations and hemorrhages in the brain sections thus far examined.

ONSET

The onset varies, but the stage is set in any proved *falciparum* case, especially one with many trophozoites, and in any case of malaria which may be suspected of harboring *P. falciparum* despite negative, conflicting, or contrary blood findings. Some patients were admitted in coma, some in delirium, some merely somnolent, some hyperpyrexia, and a few practically afebrile. In all in whom an adequate history was obtainable, headache was severe. Photophobia and vertigo were frequent complaints. An average of 1.5 days of illness prior to admission prevailed in group A; whereas, in group B the average was 3.8 days of illness. A moderate number of patients developed sudden severe cerebral symptoms one to three days after admission with, and routine treatment of, what appeared to be ordinary malaria. Three patients seen in the outpatient clinic in the morning with practically normal temperature and negative findings within twelve hours were admitted in coma. A number of patients were found in coma within two to three hours of the ward officer's rounds, at which time they had been normally responsive. More commonly, however, intense headache, somnolence or disorientation, and negativism preceded coma. Rarely a convulsion opened the cerebral drama. Occasionally ataxia, amnesia, and collapse were onset phenomena. Sphincteric incontinence or hiccough in a few instances was the "alerting" signal.

TABLE II
Summary of cerebral cases

Group A—40 cases (38 patients)—2 deaths								
Type	Cases	Somno- lence	Coma	Convul- sion	Stiff neck	Medical shock	Disori- entation	Death
<i>P. falciparum</i>	22	18	5	2	12	0	9	2
<i>P. vivax</i>	1	1	0	0	1	0	1	0
<i>P. malariae</i>	0	0	0	0	0	0	0	0
Mixed species	3	2	2	0	2	0	2	0
Undetermined	8	7	1	1	4	0	3	0
Clinical only	6	4	0	0	3	0	4	0
Total (A)	40*	32	8	3	22	0	19	2

Group B—100 cases (100 patients)—33 deaths

<i>P. falciparum</i>	66	61	48	19	26	22	57	28
<i>P. vivax</i>	4	3	3	0	2	1	3	1
<i>P. malariae</i>	1	1	1	0	1	0	1	0
Mixed species	2	2	0	0	1	0	2	0
Undetermined	19	18	12	2	8	7	15	4
Clinical only	8	8	4	2	7	0	8	0
Total (B)	100	93	68	23	45	30	86	33
GRAND TOTAL	140	125	76	26	67	30	105	35

*This case figure includes two soldiers each of whom had two attacks of cerebral malaria observed in this hospital.

The findings in cerebral malaria are in some respects uniform but for the most part are variegated and subject to rapid changes. All show some disturbance of the psyche: somnolence, coma, disorientation, delirium, negativism, combativeness, amnesia, or aphasia. All have the same leukocyte picture which characterizes malaria in general (low or normal leukocyte counts), except when complicated by infection such as a pyogenic abscess or pneumonia, when the leukocytosis characteristic of the complication is present. The fever charts follow no set pattern but real pyrexia (102° F. or higher) is the rule. A drop following therapy is to be expected within two to four days. The persistence of plasmodia in the blood after the second day of therapy is uncommon and calls for more energetic specific therapy. In the absence of plasmodia in the blood spreads, the temperature chart and the clinical picture are adequate guides to continuation of therapy. Urinalysis shows, as a rule, nothing more than febrile albuminuria. A few patients had microscopic evidence of transient acute nephritis. Two developed gross hemoglobinuria (with some hematuria) which was attributed to quinine hemolysis rather than to blackwater fever; both recovered. Three patients developed jaundice with bilirubinuria; two of these recovered.

NEUROLOGICAL PHENOMENA

The neurological phenomena are variable and may change with remarkable rapidity. The incidence of stiff neck, convulsions, coma, and delirium is shown in table II. Some patients are alternately rigid and flaccid. Sometimes rigidity and convulsive movements are Jacksonian in type. Not uncommonly one finds a moderately stiff neck without a Kernig or Babinski sign and with absent knee jerks. Contrariwise there may be transiently positive Kernig and Babinski signs, exaggerated knee jerks and abortive clonus, with or without stiff neck. Opisthotonos occurs but is not common. The loss and return of

knee jerks and Achilles jerks may be observed repeatedly in a given case. Cranial nerve palsy is rare, but in coma or spastic states many patients show concomitant deviation of the eyeballs. The ophthalmoscopic findings are normal.

Transient monoplegias, hemiplegias, and quadriplegias are occasionally observed. Dysarthria with slurred speech is not uncommon, whereas true dysphasia is rare. Athetoid movements are occasionally encountered. Trismus was observed in two patients. Tetany, resulting from hyperventilation and perhaps salt loss, was recognized in noncerebral malaria as well as in the cerebral group. It responded better to saline infusion than to rebreathing or to calcium or hydrochloric acid therapy. Central (thalamic) pain referred to the legs and arms was suspected in one patient. Parkinsonian posture, facies, tremor, and speech were present during convalescence in four patients. Disturbances of respiration were common: slow, deep, air-hunger type, hyperpnea, intermittent dyspnea, and rarely Cheyne-Stokes breathing. Tachycardia persisting despite treatment was of serious import.

OTHER FINDINGS

Severe anemia, nutritional edema, and well-marked splenomegaly were fairly common in group B, but lacking in group A. Spinal fluid pressures were generally normal. The majority of pressure readings were below 160 mm. of water. Two were recorded at 40 mm. of water and one was 600 mm. of water. The latter patient died and postmortem examination was made within two hours of the spinal tap; amazingly, his brain was less "wet" than those of the other autopsied cases (seven in this series)² whose ante-mortem pressures had all been within practically normal limits. There was no correlation between blood pressure and cerebrospinal fluid pressure. All except three spinal fluids (sixty-eight in fifty-three patients) were clear and colorless. Two of these showed faint xanthochromia which was ascribed to atabrine, although other patients who had received atabrine showed no spinal fluid discoloration. The other abnormal fluid was frankly hemorrhagic and was obtained immediately after a convulsion. This patient's fluid had been clear a few hours earlier. Whether he had a subarachnoid hemorrhage which caused his convulsion or whether the convulsion or previous spinal puncture had caused a leakage of blood is not known. A number of other patients had clear spinal fluid after convulsions. The spinal fluid cell count, sugar, and protein were within normal limits; colloidal gold curves and Kahn reactions were negative. A few blood Kahn tests reported positive during the acute phase of the illness later became negative and were classified as false positive reactions. In two attempts to demonstrate quinine in the cerebrospinal fluid negative results were obtained.

2. Both fatal cases of group A were submitted to autopsy. Group B fatalities could not be routinely examined. Special permission, however, to perform five autopsies was obtained from their own command.

A remarkable case of severe hypoglycemia in group B deserves special discussion. This lad of 19 had been well until he contracted malaria six days prior to admission. He seemed on admission to be an average case of neglected *falciparum* infection; but his smear remained positive until the third hospital day, and his temperature did not respond well to routine quinine-atabrine therapy. On the fifth day of hospitalization he suddenly became spastic, negativistic, and stuporous, and he then had a series of convulsions. Intravenous quinine and glucose produced dramatic improvement, but relapse occurred within four hours.

Considerations relative to glycogen exhaustion and responses to adrenalin observed in other cases led to the decision to make blood sugar examinations³ in all "cerebral" malaria patients. This was the first case in which blood was taken for sugar determination previous to intravenous therapy. To our surprise, the blood sugar was reported 36 mg. percent some hours later, 31 August 1943. On 1 September the level was 27 mg. percent and on the 2d it was 25 mg. percent, despite frequent intravenous infusions containing 5 percent glucose, gavage by nasal catheter of milk, rice gruel, and sugar-water, and periodic awakening from coma sufficient to permit copious draughts of sweetened tea and water. Clinical recovery began on 3 September and by the 5th, after an overnight fast, the blood sugar was 92 mg. percent. It remained normal thereafter. A normal glucose tolerance curve was obtained on 15 September (four-hour observation). The patient went A.W.O.L. but was returned a few days later, still perfectly well. He was given another four days of oral quinine (total 7.6 gm.) followed by an intravenous injection of 0.36 gm. of quinine dihydrochloride. A few hours after this, another sugar tolerance test was performed. This, too, was normal (four-hour observation). He then returned to duty and has remained well. Fourteen patients in the acute phase of cerebral malaria have now had blood sugar determinations. All but the one described above were normal.

This striking case showed severe hypoglycemia for at least three days. He gave no history compatible with previous hypoglycemia, and he recovered from malaria and hypoglycemia concomitantly. We believe that malaria caused his hypoglycemia. The hypothetical mechanism which seems most tenable is that anoxia of the hypophysis had been produced by blockage of the capillaries by parasites. That it had not reached an irreversible stage is proved by his recovery. That it was not the result of quinine (vascular spasm of the hypophysis) is suggested by the normal sugar tolerance curve obtained after repetition of quinine. There was no jaundice or other evidence of liver damage.

This experience leads us to believe that an occasional patient with cerebral malaria will be found to have severe hypoglycemia. In such cases survival of the patient may depend on recognition of hypoglycemia and on maintenance of blood sugar levels compatible with life until specific measures have removed the parasites which in some way seem to be responsible.

The management of cerebral malaria calls for a "high index of suspicion" and prompt coordinated action on the part of ward officers, nurses, and ward masters. These patients constitute true medical emergencies. Day and night vigilance and prompt measures to meet the shifting requirements of the case are essential. Some of the early, merely somnolent patients can be cajoled and "stimulated" into sufficient cooperation to make oral

3. The original suggestion was made by Captain Calvin F. Kay, M. C.

quinine therapy and oral fluid administration possible, which may occasionally be all that is needed, provided one is absolutely certain that the medication is being ingested and retained. The nasal catheter route of administration of quinine, atabrine, fluids, salt, and sugar is most useful in many cases. The great majority of these patients, however, require one or more intravenous injections of quinine dihydrochloride (0.32 to 0.65 gm.) in saline or saline-glucose infusions before they can be aroused enough to take oral medication. The greater our experience with intravenous administration of quinine dihydrochloride, the less became our fear of this procedure. The drug slowly administered and well diluted (200 cc. minimum—preferably 500 cc. or more) caused no fatalities fairly attributable to its use.

In a number of cases, the transfusion of blood or plasma brought the patient out of coma, caused the disappearance of pulmonary edema, and seemed to make the difference between life and death. A considerable number of patients have awakened from coma following spinal fluid drainage. An initial tap is always justifiable and advisable in comatose patients or those with stiff neck. The indications for repetition of spinal fluid drainage depend on the effect of the first one and the subsequent course of the illness (especially relapse into coma). Neither clinically nor at autopsy have we observed any evidence of untoward results from spinal fluid drainage, which varied in amount from 5 cc. to 25 cc.

The intravenous administration of adrenalin (1 cc. of 1:1,000 solution well diluted) proved of value in certain comatose patients; if well tolerated it may be repeated, on relapse into coma, by venoclysis in normal saline or saline-glucose, with or without quinine dihydrochloride. Adrenalin, however, is not to be used routinely, and is probably contraindicated in shock and pulmonary edema. The blood pressure response should be watched carefully and the administration discontinued if the blood pressure rises above 160 or the pulse rate is markedly accelerated or if other untoward symptoms appear. Intramuscular or oral atabrine may be used to supplement quinine but we have more confidence in quinine dihydrochloride administered intravenously, supplemented as soon as possible by oral quinine, than in any other specific in these cases.

We have learned to rely on doses of 3 to 4 gm. total quinine each twenty-four hours in cerebral or severe *falciparum* malaria. This should be maintained for two or three days and then reduced to about 2 gm. daily until the patient is out of danger of relapse. In an occasional exceptional case as much as 5 or even 6 gm. of quinine have been administered in one twenty-four-hour period. Such massive therapy is disparaged by certain authorities and is not without danger.

A few cerebral cases in group B have been treated and cured solely with atabrine (0.2 gm. every six to eight hours by mouth, together with an intramuscular injection of parenteral atabrine 0.4 gm. once in twenty-four hours for a few days).

In the fighting, maniacal, or convulsive patient intravenous sodium amytal is most useful. In the absence of this preparation we have used paraldehyde intravenously. Although aware of the dangers of the latter drug we have been forced to use it, sometimes in repeated doses totaling 15 cc. in the course of an hour, before obtaining the desired effect. Thus far no untoward results attributable to the drug have occurred. After adequate sedation, preferably with sodium amytal, the patient may then be treated by spinal fluid drainage and quinine venoclysis. Other measures tried include oxygen therapy, cold sponges, oral ephedrine or benzedrine sulfate (in the narcoleptic cases), aminophylline intravenously, and intracarotid injection of nitroglycerin or aminophylline.⁴ In a few patients pyogenic complications have called for sulfonamide therapy. Sodium bicarbonate was used in the two patients with hemoglobinuria. Efforts were made to obtain heparin in the hope that its use might prevent spreading visceral capillary thrombosis, but none of this material was available.

PROGNOSIS

The general prognosis of cerebral malaria is indicated in the mortality figures of table II (5 percent mortality in group A, 33 percent mortality in group B, 25 percent mortality in the entire series). Under ideal conditions of early treatment of *falciparum* malaria, it is believed that few patients will develop the full-blown cerebral picture. This ideal is nearly impossible to attain. Table II shows that coma itself is serious. Of the 8 group A patients with coma, 2 died. Of the 68 group B patients with coma, 28 died. Convulsions are of more serious significance. Of the 3 group A patients with convulsions, 2 died. Of the 23 group B patients with convulsions, 15 died. Of 29 "shocked" cases in group B, 14 died. It is significant that no group A patients were in real shock. The combination of coma and convulsions carries a mortality of 80 percent. When we add to this the blood smear findings of a heavy load of *P. falciparum* infection (5 percent or more of cells parasitized) we have a triad of nearly fatal significance. There were 2 such cases in group A and 9 in group B, all fatal.⁵ The converse of this situation, however, does not hold; a number of fatalities occurred in patients with few or no parasites demonstrable in the blood films. The importance of good nursing care, more constant supervision, and more active professional management is indicated by the progressive monthly decrease in our cerebral malaria mortality.

4. Suggested by Major A. M. Walker; performed by Major N. E. Freeman.

5. Subsequent experience makes this observation less definite. Two patients exhibiting this triad recovered.

In general, cerebral malaria either kills or is "cured" without residual disability. A few patients had moderate degrees of parkinsonism for several weeks after recovery. In one patient this persisted for eight weeks with very slow improvement and a final picture suggesting the possibility of slight permanent slowing up of psychomotor reactivity. The battle for life in cerebral malaria is usually won or lost in the first seventy-two hours.

COMPLICATIONS

Complications and sequelae of therapy encountered were: one case of quinine amblyopia (partially recovered), one of quinine deafness (recovered), 2 postatrabrine psychoses (recovered), 2 with hemoglobinuria due to quinine (recovered), and one with plasmochin hemolysis (recovered). Three patients developed jaundice of undetermined etiology; 2 of these recovered.

The modes of death followed no set pattern. The majority died in coma. Death in, or immediately following, generalized convulsions occurred in 15 cases. The final temperature recorded before death in most cases was 102° F. or higher (up to 107° F.), and pulse rates of 130 or higher were the rule. A number, however, were cold, cyanosed, gasping, and practically pulseless for an hour or more before death. In most of the cases in which such observations were made, respiration ceased before the heart stopped beating. Two patients died suddenly and unexpectedly without observed convulsions and without preceding pulmonary edema. Hiccoughing, sphincteric incontinence, vomiting, and inhalation asphyxia were terminal events in a few cases. In one case the ward officer believed that the heart stopped just prior to, rather than after, a terminal convulsion.

Death in cerebral malaria is no doubt conditioned in many cases, as the syndrome of cerebral malaria itself is conditioned, by multiple visceral and circulatory factors, in addition to purely cerebral factors. In the autopsied cases characteristic malaria pathology was present, not only in the brain capillaries (sometimes localized, sometimes widely disseminated), but also in the lungs, heart, kidneys, liver, lymph nodes, spleen, stomach and intestines, adrenals, pancreas, and bone marrow. The primary pathology, as we have seen it, appears to be endothelial capillary cell proliferation and swelling, with intracapillary engorgement, distension, and "plugging" by pigment-laden cells and parasites (or at least the pigment-remains of parasites). There were also suggestions of neighborhood edema and in certain organs, notably the lungs, neighborhood extravasations of blood and infiltration with pigment-loaded macrophages. The myocardial capillaries were markedly involved in 3 cases, the lungs in 3 cases, and the liver and spleen in all of those examined. *Falciparum* malaria is obviously a disease in which the reticulo-endothelial system is the major battleground.

SUMMARY

1. In 6,059 total cases of malaria treated in this hospital, 140 cases of cerebral malaria were encountered, a cerebral incidence of 2.3 percent.

2. The cerebral malaria mortality in group A (American) is 5 percent; in group B (soldiers of an allied nation), 33 percent; in the entire series, 25 percent. The two cerebral deaths in group A constitute the sole malaria mortality in 1,764 cases malaria in this group. The reasons for the relatively unfavorable mortality rate in group B are outlined.

3. The importance of vigilance and of early and active treatment is stressed, with particular reference to the sure and certain introduction of quinine dihydrochloride by intravenous injection, supplemented by nasal catheter or carefully controlled oral administration of quinine sulfate.

4. Confidence is expressed in the value of spinal drainage in the coma cases, the cautious use of adrenalin in intravenous saline and glucose infusions in certain comatose cases, the use of intravenous sedatives in maniacal or convulsive cases, and blood or plasma transfusion in those with anemia, shock, or pulmonary edema.

5. The one case of the hypoglycemic form of cerebral malaria in this series is the first and only case of its kind known to us. While it may be a very uncommon coincidence, in any event, it deserves further study.



Left: Aerosol spray bomb being used in a dugout to combat malarial mosquitoes. Fifth Army, Nettuno area, Italy, 1 April 1944.

Right: The rotary duster, one of many methods of malarial control. The dust, containing Paris green, spread on stagnant water destroys mosquito larvae. Fifth Army, Nettuno area, Italy, 1 April 1944. Signal Corps photographs.

Sympathetic Ophthalmia

Its Relation to War Injuries

MAJOR M. E. RANDOLPH

Medical Corps, Army of the United States

Sympathetic ophthalmia is a destructive disease of the uveal tract of one eye which, when it occurs, usually follows injury or perforation of the fellow eye. Less than 2 percent of all perforating ocular injuries develop this disease, and in each successive war, the incidence has decreased. This decrease has been attained through a realization of the importance of the disease, the proper care of all injured eyes, and the application of prophylactic enucleation. It is pertinent, therefore, to review this subject in the light of war injuries to the eye.

An eye is always dangerous and potentially able to cause sympathetic ophthalmia if there is a rupture or perforation of the globe, especially when complicated by injury or prolapse of uveal tissue. In rare instances, it can occur without perforation of the globe. Sympathetic ophthalmia never develops before ten days and usually not before two weeks after the initial injury. The high point of incidence is between three weeks and three months, although the onset may be delayed for years after the initial injury. Therefore, the first two weeks following injury may be considered the "safe period."

The most important consideration is its prevention, and the prompt enucleation of an eye following a severe injury is the safest and most reliable prophylaxis. If an eye has sustained a severe injury and is hopelessly lost, enucleation should be performed with the least possible delay. If, however, the injured eye still retains some degree of vision with accurate light projection, whether or not enucleation should be performed may be a difficult decision. Here, advantage can be taken of the "safe period." In doubtful cases, in forward installations, enucleation should be done only when extensive damage to the eye and orbit and removal of the ocular remnants is a necessary procedure in the surgical repair of the area. It should be stressed that while enucleation is not a difficult operation, it should, whenever possible, be done only by one who is thoroughly familiar with the proper technique.

From the Surgical Consultants Division, Office of The Surgeon General.

In forward installations, pending enucleation or while awaiting repair of an injury, the injured eye should be atropinized, sulfathiazole ointment applied, and both eyes bandaged. The immobilization of both eyes is particularly important, as movement of the eyes is minimized with lessening of the danger of wound-gaping and further prolapse. Every case of perforating injury should be x-rayed as soon as possible for the presence or absence of an intra-ocular foreign body. If the eye must be removed, enucleation with a glass ball implant in Tenon's capsule is the operation of choice. Evisceration (Lister "frill operation") should be limited to those cases showing a purulent endophthalmitis where direct cutting of the optic nerve would be accompanied by the danger of extension of the infection to the meninges through the optic nerve sheaths. If the eye is susceptible to repair, the actual repair of the injury should consist of a wide excision of the prolapsed tissue and the close approximation of the wound edges with corneoscleral sutures. If such sutures are not desirable, a previously prepared conjunctival flap may be used to cover the wound. At times, it may be feasible to reinforce the corneoscleral sutures by a flap. Atropine, sulfathiazole ointment, and the binocular dressing should again be used. There is little if any need to dress the eye for four days. If a conjunctival flap has been used, it may have partially retracted by this time. The corneoscleral sutures should not be removed for at least eight days. Systemic sulfa therapy should be started as soon as possible after the initial injury. Following the first dressing, the uninjured eye should be daily examined with the slit lamp and ophthalmoscope.

There is no accurate way to foretell from the injured eye (exciting eye) whether or not sympathetic ophthalmia will develop in the other eye (sympathizing eye). In general, wounds through the ciliary body with prolapse are more dangerous than those through the cornea without prolapse. The retardation of healing with its concurrent iridocyclitis is definitely a dangerous sign, whereas rapidly healing wounds with coincident clearing of the eye are less dangerous. Except in rare cases, a perforation followed by a purulent endophthalmitis is less liable to produce the disease.

The onset of sympathetic ophthalmia is insidious. The sympathizing eye may either show an anterior or posterior uveal involvement, the former being more common. With the anterior type, the characteristic picture is that of a low-grade iritis associated with visual failure and the absence of pain. Keratic precipitates are visible, and the slit lamp reveals a positive aqueous beam. The iris become lusterless and thickened, the pupil immobile and bound to the anterior lens capsule. The massive cellular reaction with low-grade inflammation is characteristic. At this

stage, mydriatics will have no effect. Vessels from the iris invade the lens capsule forming a vascularized pupillary membrane. The latter is a characteristic sign of the heightened stage of the disease. In the posterior form, there is disturbance of vision with an initial absence of iritis. The media are clear at first. There is edema of the posterior pole with swelling and congestion of the nerve head. The typical sympathetic chorioretinitis may be seen. This consists of small, discrete, reddish white or yellowish white spots scattered throughout the mid-periphery. Regardless of which type is the first lesion, unless arrested, the disease soon spreads throughout the whole uveal tract, although in a small number of cases the disease may subside after enucleation of the exciting eye. Secondary glaucoma is the usual sequel. After months of severe exacerbations, the process finally subsides. By this time, the eye has usually gone into phthisis, although occasionally some degree of vision may eventually be preserved.

Mention must be made of sympathetic irritation. Not infrequently from thirty-six to forty-eight hours to seven or eight days after injury, the patient may complain of lacrimation and photophobia in the uninjured eye. Indeed, it is not an uncommon accompaniment in many corneal conditions and nontraumatic intra-ocular diseases and is thought to be due to reflex irritation. Although its presence after ten days following injury may make one suspicious, a careful examination with the slit lamp and ophthalmoscope reveals no evidence of cellular infiltration, and there is no difficulty in its evaluation.

If the diagnosis of sympathetic ophthalmia can be made early, the injured eye must be enucleated with the least possible delay. This applies also to injured eyes which still retain vision and light projection. On the other hand, if the disease is well developed, unless the exciting eye is hopelessly lost, it is questionable that its enucleation will have any effect on the eventual outcome of the disease. It is not infrequent in severe disease that when the process has finally subsided, the exciting eye may have the better vision of the two.

Once the disease has been discovered, whether or not enucleation has been performed, the following treatment should be started: Nonspecific protein therapy should be given—a course of triple typhoid vaccine starting with an initial dose of 25 million, increasing 10 million per dose every three days for at least eight injections. Except during the course of typhoid vaccine, sodium salicylates should be given, the standard dosage being 200 to 250 grains per day for the first three days and subsequently one grain per pound of body weight. When the process has been brought under control, one-half the subsequent dose should be given three times a week for at least a month longer. At this time, no evidence exists that the sulfonamides or penicillin have any effect whatsoever on the course of the disease.

Disability Discharges

This is a résumé of the Army's experience with discharges for physical reasons given to enlisted men under the provisions of section II of AR 615-360. Such discharges are generally referred to as certificates of disability for discharge. While the essential decision to discharge enlisted men for physical reasons rests on the findings of a board of medical officers, the number of enlisted men coming up for discharge and the number of C.D.D.'s granted reflect preponderantly the Army's personnel policies rather than the occurrence of physical defects as modified by changes in physical standards or other medical considerations. A review of the trend of the discharge rate for physical reasons from June 1943 through September 1944, in the light of various directives pertaining to discharges, brings out clearly that the discharge rate has been markedly influenced by administrative policies. It is seen that the more conservative discharge policy adopted in November 1943 was largely responsible for the sharp decline in the number of C.D.D.'s from about 240,000 during the last six months of 1943 to some 94,000 during the first six months of 1944.

TREND OF THE DISCHARGE RATE FOR PHYSICAL REASONS

In June 1943 the discharge rate for physical reasons was reported at about 0.4 percent of the enlisted strength for the month. It rose slightly in July and again in August to reach 0.6 percent for the latter month. The peak discharge rate was recorded in September at almost 0.9 percent. In October the rate dropped to 0.8 percent and in November to about 0.55 percent. By December the discharge rate was back to the June figure. In January 1944 there was a further decline to 0.35 percent, which continued through April. During the second quarter of 1944 the discharge rate remained practically level at 0.18 percent per month. In July and August 1944 the rate rose slightly, and in September more sharply; even so, the discharge rate for September 1944 was estimated at only 0.25 percent for the month.

The sharp rise in discharges during August and September of 1943 is traceable to the directive (W.D. Circular No. 161, dated 14 July 1943) requiring re-examination and discharge of limited service men who did not meet current physical or mental standards. In October, when the number of limited service men discharged had dwindled to a small figure, the rate of discharge began to decline. In November, a new policy was announced in W.D. Circular No. 293, which stated in effect that no man was

From the Medical Statistics Division of The Surgeon General's Office.

to be discharged for physical reasons so long as there was some position in the Army which he could fill. This policy was reiterated in April 1944 (W.D. Circular No. 164). The sharp decline in the discharge rate from November 1943 to the second quarter of 1944 reflects chiefly the execution of this policy. A minor factor affecting the decline in discharge rate during this time was the reduction in the numbers of newly inducted men, among whom the discharge rate has been relatively high.

The rise in the discharge rate in July and August 1944 is attributable mainly to increasing discharges among men with overseas service, as the numbers of such men evacuated have mounted steadily in recent months. The sharp rise in the discharge rate during September 1944 reflects not only a continuation of this trend, but also the effects of W.D. Circular No. 370, dated 12 September 1944, which provided that enlisted men in the United States who did not meet the minimum physical induction standards for limited service and for whom appropriate positions were not reasonably available could be discharged.

So far there has been only a relatively small increase in the number of disability discharges given to battle casualties. It should be borne in mind that the discharges traceable to the large numbers of battle casualties suffered in the invasion of France are yet to come. Late in April 1944, under the provisions of W.D. Circular No. 164, combat wounded personnel who as a result of wounds became permanently qualified for limited service only were given the option to be discharged. Since late in May, such personnel if permanently below the minimum standards for induction have been given discharges under section II of AR 615-360 (section I, W.D. Circular No. 212, 29 May 1944). Although the number of these discharges to date has been small, it is reasonable to anticipate an increase in the discharge rate, because of this directive, when much larger numbers of combat wounded personnel come up for disposition in the future. The upward trend in the discharge rate may also be reinforced by the effects of such directives as W.D. Circular No. 370 to which reference was made.

CAUSES OF DISCHARGE

The table shows the percentage distribution by cause of disability discharges granted for physical reasons during the last six months of 1943 and the first six months of 1944.

Discharges for neuropsychiatric disorders have continued to be the largest single class of disability discharges, currently accounting for almost 50 percent of all discharges as compared with about 40 percent in the latter part of 1943. The actual rate of discharge for neuropsychiatric disorders (that is, the numbers released per 1,000 enlisted men in the Army) has, during the first half of 1944, decreased to less than one-half of that reported for the last six months of 1943. Psychoneurosis continues to be responsible for about three-fourths of all

neuropsychiatric disorders. It should be understood that the overwhelming majority of the men discharged for psychoneurosis are merely not suitable for Army assignments and have little difficulty in adjusting themselves to civilian life. Such discharges reveal a lack of adaptation to the stresses of Army life and especially to combat conditions, and many of them occur in individuals who would show no overt symptoms in a nonmilitary environment. Consequently, many individuals who later will fall in this category are not discoverable at the time of induction. Of the other neuropsychiatric disorders, psychosis remains the most serious problem.

Cause of discharge	Percentage distribution of all causes	
	1943 July-Dec.	1944 Jan.-June
Tuberculosis	1.2 percent	2.0 percent
Venereal diseases	0.6	0.9
Infectious and general diseases	8.9	8.7
Neuropsychiatric disorders	39.4	48.3
E.E.N.T. conditions	10.1	5.2
Respiratory diseases	5.9	5.0
Cardiovascular diseases	6.4	6.5
Gastro-intestinal diseases	4.8	9.6
Genito-urinary diseases	2.0	2.0
Musculoskeletal conditions	18.7	8.1
Traumatisms	1.9	3.6
Other diseases or conditions	0.1	0.1

After neuropsychiatric disorders, the most important causes of discharge during the first six months of 1944 have been: gastro-intestinal diseases (about 10 percent of total discharges); infectious and general diseases (9 percent); and musculoskeletal diseases (8 percent). The largest decreases in the rate of discharge have been reported for musculoskeletal and eye, ear, nose, and throat conditions.

OVERSEAS SERVICE

As might have been anticipated, traumatisms and neuropsychiatric disorders, which reflect battle casualties, loom very much more important as causes of discharge for men with overseas service than among men whose service has been confined to the United States. Discharges for tuberculosis also appear to be relatively high among men with overseas service. On the other hand, discharges for musculoskeletal, genito-urinary, cardiovascular, and respiratory diseases (other than tuberculosis) seem to be more frequent among men who have not been overseas.

CONCLUSIONS

The Army's personnel policies have undoubtedly been the most important single factor affecting the trend of the discharge rate for physical reasons. Changes in such policies,

perhaps in the direction of greater liberality, are likely to continue to be the dominant influence; however, the large number of battle casualties sustained in recent months and to a lesser extent the associated increase in admissions for neuropsychiatric disorders under prolonged exposure to combat also appear as important developments operating to produce a higher discharge rate for physical reasons.

Plant Collecting by the Armed Services

EGBERT H. WALKER

Smithsonian Institution

Scientific plant collecting, or the making of pressed specimens of flowers, fruits, and leaves, may afford a welcome pastime to some members of the armed forces. Collections so made can be of great help to centers of scientific study to which our military leaders frequently turn for solutions to war problems. It has been possible to answer many of their questions, because explorers and professional and amateur scientists have for years been gathering natural history specimens of all sorts from the far corners of the earth and sending them to museums where they can be preserved for study and classification. Among these collectors have been Army and Navy personnel accompanying expeditions or stationed in various posts throughout the world. On the basis of collections made by interested friends of the Institution, our botanists have been able to aid the war effort in many directions by giving information on emergency or supplementary foods, poisonous and drug plants, and plants useful in construction and camouflage. In great measure it has also been possible, by recourse to the national collections, to satisfy the curiosity of our men in out-of-the-way places who are seeing strange sights and meeting with new plants and animals. In this way their many questions can be answered and names furnished for the specimens that they collect.

Every man in the service, medical or otherwise, has a rare opportunity to engage in the fascinating and highly worthwhile occupation of collecting scientific plant specimens for our great institutions. Already a number of servicemen have found this pursuit an enjoyable recreation, and their collections have proved to be of great scientific value. Specimens have been received from parts of the world where no collections were ever made, but these are only a drop in the bucket compared with what could be gathered if the men in the services realized the importance of the material to our large reference collections. The plants that you see every day about you really are desired in scientific collections.

A lupine hastily stuck in a private's pack while hunting Japs during the Aleutian campaign proved to be a new species, and a collection of over 150 specimens made by this soldier during his stay in that general region was of inestimable value in preparing an account of the plants of the Aleutian Islands for distribution among the members of the armed services located in that area. The rarities that he collected, of course, could not be recognized in the field, but they came to light when the collection was studied and compared with other specimens in the Smithsonian Institution.

One should remember that many groups of plants besides seed and flowering plants are worthy of attention, such as lichens, mosses, liverworts, algae, and the lowly fungi which cause various plant diseases. Marine algae are abundant around oceanic islands, and valuable collections can be gathered at low tide almost anywhere.

No special training is required to collect a botanical specimen. Better results can be obtained, however, by following certain simple instructions. The equipment needed is easily improvised from discarded cartons, newspapers, and other cast-off materials. The methods followed vary with the type of material collected but consist essentially of drying the specimens while held flat under moderate pressure.

To encourage and aid scientific collecting, the U. S. National Museum in Washington has published a pocket-size "Field Collector's Manual in Natural History," a copy of which will be mailed on request to any one in the armed forces who is interested. This covers the main techniques of collecting plant, animal, geological, and paleontological specimens. Furthermore, the Museum has prepared for distribution on application general accounts of the plants, birds, butterflies, fishes, mollusks, reptiles, amphibians, starfishes, and sea urchins and their relatives in the southwest Pacific, and is prepared to assist interested collectors in learning more of the natural history of occupied and to-be-occupied areas. Efforts will be made to report promptly and as completely as practicable on all collections received if names are desired by the senders. Correspondence by collectors of natural history material in all branches of the armed services is welcomed.

Each specimen must be accompanied by notes showing the date of collection, the habitat and locality where found, and brief mention of the main characters of the plant, as height and shape, color of flowers, and such other features as will not be observable in the dried specimen. Under present military restrictions, specimens often cannot be sent accompanied by the needed data on localities and dates of collection. This difficulty may be overcome, however, by numbering each specimen shipped and retaining the restricted data correspondingly numbered in notebooks. These can be turned over to the receiving institution after the war or when restrictions are re-

laxed. In any case, if at all possible, deposit the original or at least a copy of the data with your intelligence officer for transmittal to the Smithsonian Institution under proper safeguards when permissible.

If packages of plants contain no other written matter than the collector's name and a serial number on each sheet or folder and are addressed to the Smithsonian Institution, they will not be held up by the censor or become involved in quarantine restrictions.



Wounded Americans are transferred from a Coast Guard assault transport, where they received emergency treatment, to a tank landing craft in the English Channel for transport to an English port. Coast Guard photograph.

Trench Foot

Report of 351 Cases

MAJOR JOSEPH C. EDWARDS

Medical Corps, Army of the United States

CAPTAIN MORRIS A. SHAPIRO

Medical Corps, Army of the United States

and

CAPTAIN JENNINGS B. RUFFIN

Medical Corps, Army of the United States

Exposure of the feet for several days to cold, damp weather frequently results in a condition known as trench foot. The outside temperature required to cause trench foot is not so low as that required for frostbite, mainly because of contact of the extremity with water. Aside from its local action on the skin, water conveys heat away from the extremity faster than does air and soon causes vasoconstriction. The further action of cold in the presence of an increasing anoxia of the tissues and muscles results also in damage to nerves, and the part feels numb and cold at first so that the soldier hesitates to exercise his feet. As soon as the feet begin to get warm after such exposure, the toes tingle and either burn or ache. It is in this period of too rapid thawing that much unnecessary damage may occur. Pains may ascend through the foot to the knee with the vasodilatation that occurs in the damaged tissues. In patients with capillary damage, this warning stage brings exudation of serum and tissue fluids, causing sterile inflammatory reaction and blebs, some of which may cover the entire plantar surface of the foot and contain bloody fluid. Any degree of injury may result, varying from coldness of the feet for a few days with stiffness to gangrenous toes and feet with large blisters that require months before normal walking is possible. A few require amputation. We observed a patient with absent or decreased dorsalis pedis artery pulsation in one foot as long as six months after the onset of trench foot. This foot remained cool and moist but was never swollen. In 12 percent of bodies, Gray's Anatomy states, the dorsalis pedis artery is so small that it may be spoken of as absent. In 3 percent its place may be taken by a large perforating branch of the peroneal artery.

GRADES OF SEVERITY

Grade I, mild. Cool feet with numb great toes and slight ache or stiffness, but no discoloration, blebs, or swelling and no decrease of dorsalis pedis and posterior tibial artery pulsation. Back to duty in two weeks.

Grade I. Cool, sometimes moist, feet with slight cyanosis but no blebs, stiffness, or severe pain interfering with sleep. Usually back to duty within six weeks to three months. Dorsalis pedis and posterior tibial arteries pulsate normally. There may be mild aches for a time, when feet are too warm.

Grade II. Cold, cyanotic feet, moist at times, with decreased or absent dorsalis pedis part of the time, aches at night interfering with sleep for several days and tenderness to pressure over metatarsal pads. Within a week from onset they may become warm, swollen, and tender. Back to duty in two to six months, averaging four months. Some will be unable to do combat infantry duty.

Grade III. Cold, mottled, cyanotic feet, with large blebs or areas of ecchymosis, pain on motion of toes or pressure over metatarsal pads, with continuous pain and aching in feet day and night and later in desquamation of thick layers of skin, often with absent dorsalis pedis and poor posterior tibial pulsations. These pulses may come and go for several days, particularly the dorsalis pedis. After a few days, the feet may become



FIGURE 1. Grade III trench foot one month from onset. Swelling subsiding. Desquamation and darkened skin leaves new pink skin beneath with no areas of gangrene in this patient. Unable to bear his weight flat footed at end of three months. Stiffness of toes prolonged with aching on walking. Dorsalis pedis pulse present.



FIGURE 2. Grade III two months after onset. Swelling is subsiding. Feet still too tender to walk well after three and one-half months.

warm and swollen with little or no cyanosis and have a bounding dorsalis pedis pulse. Back to duty in six months or more; many must be on limited duty (figures 1 and 2).

Grade IV. In addition to conditions described above, patients in this grade have areas of gangrene over toes and black nail beds with marked swelling and pitting edema of the feet. This may result in physiologic amputation of toes. In a surprising number, the black dermis peels off gradually, leaving granulation tissue underneath. A few have gangrene with necrosis of the entire toe or foot and require amputation.

COURSE

The feet become purple or cyanotic when dependent and may blanch when elevated, indicating a slow, subcutaneous circulation in spite of dilation of arteries in the foot with in-

creased circulation in deeper tissues. In a few weeks the general swelling and sterile inflammation subside, leaving a foot tender to pressure over the plantar surface of metatarsophalangeal area with some return of sensation to the toes. The great toe is more often affected by numbness, blisters, and paresthesia. Ecchymosis and superficial burning may be on any or all toes, especially at pressure points in contact with the shoes and over the dorsum of foot and on the heel. The toes remain stiff for weeks or months in moderately severe and severe trench foot. Some patients have flexion of toes which sometimes takes six months or more to straighten out.

The patients who exhibited any tendency to contracture of the toes or who were unable to move the toes on admission were tested with faradic-galvanic current to determine the status of nerve and muscle function. None were found to have absence of response.

In the grade I and II cases, mild ache and tenderness on plantar surfaces of metatarsal arch after walking persist for several months. Most milder cases lose much of the aching after the first week of hikes. These complaints may be prolonged and exaggerated in introspective individuals. The grade III patients may have tenderness on walking for six months or more and few are able to return to full field duty at all. What they will be able to do in a year remains to be seen.

Davis¹ et al. quote Sir Thomas Lewis as stating, "If the skin is sufficiently cold, 10 degrees centigrade (50 degrees F.) or less, the blood will not part with its oxygen." They continue, "If we assume Lewis to be correct, it seems illogical to reduce the temperature of the already damaged tissue below 10 degrees centigrade to the levels of 2 to 5 degrees centigrade recommended by Greene. The point stressed by him that the metabolic requirements of the tissues are lowered at the temperature he recommends seems of little consequence in comparison with the fundamental fact that no oxygen is released by the blood to the tissues at these temperatures." This makes it possible for cellular damage and destruction to occur at temperatures in the tissues above the critical level of -5 to -7° C.

In experiments in which the tail of a rat was exposed to cold and wet, Blackwood and Russell² found that the muscles and nerves were much the most vulnerable tissues. They were conspicuously damaged after thirty-eight hours' exposure and more severely damaged after longer exposure. The skin and other tissues including blood vessels appeared more resistant to chilling. Two months after exposure, the nerves and muscles had not returned to normal, and in rats surviving sixty days, some evidence appeared that muscle degeneration secondary to denervation was setting in.

1. Davis, Loyal, Scarff, John E., Rogers, Nell, and Dickinson, Meredith: *High Altitude Frostbite*, Surg. Gyn. Obst., 77:561-575, December 1943.

2. Blackwood, W., and Russell, H.: *Experiments in the Study of Immersion Foot*, Edinburgh M. J., 50:385-398, July 1943.

White and Warren³ believe that the pain in immersion foot subsides only when fibrous tissue ceases to contract. They found no effective treatment once the fibrosis had developed. They believe that artificial cooling of the injured limbs early in the period of recovery should do much to prevent fibrosis and the prolonged incapacity which may follow in its wake from rigidity of the feet and from pain.

Their microscopic study of biopsies revealed an increase in interstitial connective tissues and collagen, which involves the blood vessels, muscle fibers, and nerves. Pain of this type tends to clear after six to eight months, the period at which the collagen surrounding the nerves ceases to contract.

TREATMENT

The first principle in the treatment of trench foot is to rest in a cool place, keeping the body comfortably warm and clean. This is done by daily washing with 70° F. soapy water, gentle drying of the feet, and either cooling the surface of the feet by air currents from a fan or by exposing them to room temperature not exceeding 70° F. but preferably about 50° F. This and absolute bed rest promote vasoconstriction and decrease local metabolic requirements. The body should be warm with enough blankets to make the patient comfortable. Some grade I, mild, and grade I patients are started to the latrine and to mess immediately. As soon as the acute pain has passed, within a week in grades I and II, the patient is started on passive vascular exercises. He elevates his feet at an angle of 45 degrees on a board or chair for two and later five minutes; keeps legs horizontal for five minutes; then sits with his feet over the edge of the bed for two and later three minutes, followed by resumption of the horizontal state. This is repeated three to four times daily during the next week or so while the patient is at bed rest. This, with calisthenics in bed each morning conducted by the ward master, helps keep these patients in good physical condition. Cool water soaks and whirlpool baths at 70° F. for twenty to thirty minutes daily help temporarily. Whether or not they shorten the recovery period was not established. Not all patients could stand the cold water. Some found it relieved the aches and pains during the time the feet were in the water. Those with painful, swollen, warm feet usually did obtain relief. It is used empirically and those who obtained relief were allowed to continue the treatment. Cooling the feet at bedtime would enable many to get to sleep without sedatives or analgesics.

In this connection, 150 to 300 cc. of 5 percent saline intravenously daily often gave immediate symptomatic relief from aches and pains. Permanent relief was obtained after four to seven days' treatment in some cases, although no consistent

3. White, James C., and Warren, Shields: Causes of Pain in Feet After Prolonged Immersion in Cold Water, *War Medicine*, 5:6-13, Jan. 1944.

effect on swelling was noted. In many cases the decrease in swelling was more rapid than usual. This treatment was used effectively in nineteen patients who previously had no relief from codeine, gr. $\frac{1}{2}$, and aspirin, gr. 10. Two patients who were unable to walk because of swollen painful feet were not relieved. Intravenous hypertonic saline relieved the pains and aches that were present at rest but did not affect to any extent the tenderness and pain on walking. In relieving symptoms in cold and nonswollen feet, 50 percent glucose in 50 cc. doses and normal physiologic saline intravenously were tried without success. Nicotinic acid (50 mg.) and thiamin chloride (50 mg., t. i. d.) were tried on six patients for a week without relief of symptoms. Patients received regular diets and in a few cases where indicated, polyvitamin capsules. No specific effect was noted.

Hyperhidrosis is a late complication of trench foot. It may cause some maceration of the skin, particularly by undermining it about the heel and toes. This is a good medium for fungus infection, which is very difficult to eradicate. Potassium permanganate water soaks, 1:5,000 and 10 percent formalin are of value. Patients with this condition, on whom sympathectomy was done on one side, improved remarkably in that foot but not in the other foot. Excision of the second and third lumbar sympathetic ganglia was of value in patients with gangrene of the toes.

Laboratory data were not revealing. Red and white blood cell counts and urine analyses were normal in uncomplicated cases. Two of six patients on whom x-rays of the feet were made showed some evidence of demineralization that could be explained by the preceding period of inactivity. Blood N.P.N. was normal in three grade IV cases in which it was obtained.

REHABILITATION

All patients were reassured as to their eventual recovery. Lectures were given on the proper care of the feet. Undue exposure when not absolutely necessary was stressed. As soon as they were able, they were out of bed part of each day. From two to seven days later, depending on the severity of the condition, they were allowed to go to the mess hall outside the ward. It is important to realize that most of these patients, on walking, have aches and pains in the muscles and metatarsophalangeal joints for several weeks after the feet appear normal. After they cease to have pain during ordinary walking, many overcome slight aches after hikes by persisting in walking even though the feet ache for the first few days.

Occupational therapy, reading, writing, games, and entertainment for bed patients, and outdoor exercise for the ambulatory, are essential. When they are safely ambulatory, their attendance is required at daily organized hikes, which are gradually increased in length compatible with the patients'

condition. As soon as they are able to walk 3 to 5 miles without undue trouble, they are ready for duty. If after three months they show continued swelling of the feet, persistent pain, cyanosis, or hyperhidrosis after such marches, although such things were not present after 1-mile hikes, they are not ready for duty and will not be for a long time. Those unable to march 10 miles will not do infantry combat duty for some time but could do combat artillery or ordnance duty.

The establishment of a conditioning and rehabilitation section in the hospital has aided in the improvement of the cases. In this section they are up for formation each morning, take calisthenics, stand retreat, and have supervised lectures on current events, orientation, and combat problems. Some have daily hikes or drill. Others work in the hospital as ward men, help in the post office, in the Red Cross, the message center, or as clerks, mechanics, or telephone operators during their convalescence. With the establishment of temporary limited duty, many of the patients are discharged to a reception and conditioning center on a limited duty status for as long as six weeks, then sent to full or limited duty. This allowed more to remain in the theater until ready for duty. Some could do class B or permanent limited duty who could not stand up on long marches in all kinds of weather or terrain.

DISPOSITION OF CASES

During the winter of 1943-44, a total of 351 patients with trench foot was admitted to the hospital. The dispositions made were as follows:

TABLE I

	13 July 1944	Percent	Average Hospital Days
Temporary limited duty	12	3.4	67
Permanent limited duty	24	6.8	60
Zone of the interior	23	6.5	70
Full duty	292	83.3	45.5
Total	351	100	60.6

Eight of the 23 patients sent to the zone of the interior had gangrene of the toes and two had severe swelling and tenderness after two months. One of these had varicose veins with phlebotrombosis in one leg as a complication. Follow-up of the temporary limited duty patients in the conditioning center revealed that 11 were put on permanent limited duty after failure in four to six weeks of outdoor calisthenics and 1-mile marches daily. Two of them were readmitted; and the others were reclassified from the reception center after we had seen them there on a follow-up visit. (See table I for final figures.)

Two hundred fifty-three of these patients were followed closely during their hospital stay. The average number of days at bed rest per patient was ten days. An average of twenty-four days elapsed before long walks outside the area were attempted. During this time they were up to the latrine, up

in the ward, and went to the mess hall for meals, a distance of one-quarter mile.

The average number of hospital days for all grades was sixty days. All patients went through a rehabilitation period of daily hikes before returning to duty.

Nine grade I patients were started on daily hikes, on an average, on the fourteenth day; fifteen grade II patients were started on hikes, on an average, at the twentieth day; and two grade III patients required thirty days before starting hikes.

The grades I and II patients were started to mess, a distance of 250 yards, on an average, on the fourteenth day. Grade III patients were up to the latrine but were fed on the ward for three to four weeks. Most of the grade I patients were allowed up to the latrine within three to seven days after admission to this hospital, or about the first to second week from the onset. Each case is an individual one and must be carefully so considered before being allowed to go on hikes. The use of salvaged shoes with toes cut out greatly facilitates early locomotion.

Eleven were kept the ninety-day limit for general hospitals in this area. Five of these were sent to the zone of the interior. Usually one could determine early the cases that would be unable to do duty in this theater for several months or more and return these to the zone of the interior soon after admission.

Seventy-two patients were in the hospital seven to eight weeks and 51 were in less than six weeks. The rest were in over eight weeks.

READMISSIONS

Fourteen of the 330 patients sent to some sort of duty in the theater were later readmitted to this and other hospitals in the area. Four were eventually returned to full duty and one to temporary limited duty. Seven were placed on permanent limited duty. Two on temporary limited duty were returned to the zone of the interior after failure to do temporary limited duty. One failed primarily because of psychoneurosis, anxiety state, and neurocirculatory asthenia, and the other because of a poor attitude during both admissions; he had grade II trench foot with cyanosis and aches.

Thirty patients with previous hospitalizations for trench foot were admitted here during June because of continued or recurrent symptoms of trench foot. Two of this group had been under our care and are included in the fourteen (4 percent) readmissions.

All readmissions were precipitated by hikes or walking two or more miles. Maceration of the skin and epidermophytosis occurred in 25 percent. It was the third admission for one and the fourth for another. The latter two had no periods of rehabilitation. Five of the seven on A-2 duty were later unable to march two miles without pain in the feet and were put on permanent class B duty.⁴

4. From the files of Lieut. Colonel Slim Fields Beam.

Four others had been referred as trench foot cases but proved to be cases of epidermophytosis with no previous signs of trench foot.

Six of the patients with trench foot developed severe epidermophytosis resistant to ordinary treatment. We have seen patients with a previous history of trench foot readmitted for the second or third time because of aches in their feet after long walks. A few had aches in the feet when walking about the ward. Three had hyperhidrosis in the sixth month of trench foot. At least two were primarily hypochondriacs. Some patients exaggerate the symptoms of trench foot.

We have had correspondence from several of our patients who have returned to duty. All of them have been more aware of the necessity for proper foot hygiene, and despite combat conditions have followed instructions well. Conditions did not always permit daily bathing of feet with soap and water followed by careful drying. They did apply Q.M.-issue foot powder daily after massage of the feet and got along with a minimum of trouble with hyperhidrosis and epidermophytosis.

EFFECT OF SYMPATHECTOMY

Eleven patients with grade III and two with grade IV trench foot were selected, on the advice of Major F. A. Simeone of the Surgeon's Office, NATOUSA, and Major H. G. Schwartz, for lumbar sympathectomy in an attempt to relieve the constant pain and prolonged tenderness. We did not expect any sudden relief of symptoms since it had not occurred after lumbar sympathetic novocain blocks on other patients. We did hope to increase the blood supply to the skin and perhaps save some areas adjacent to advancing gangrene in the toes of some.

The results of this study will be reported later. Suffice it to say that two months after the unilateral excision of the second and third lumbar sympathetic ganglia, the results are good in those with gangrene of the toes. It did not much help those with tender, painful, aching feet of the swollen, warm, and nonswollen types. All of the thirteen patients were sent to the zone of the interior. While the hyperhidrosis and epidermophytosis were relieved in most of the patients, it is not a cure-all for trench foot.

CONCLUSIONS

As soldiers in combat cannot always change their socks daily and remain warm and dry all the time, trench foot will continue to occur. The incidence can be lowered if the following principles are followed as far as practicable under the circumstances:

1. Daily cleansing of the feet. If water is not available, wring out the socks and then massage the feet gently. This includes proper instruction in the prevention and treatment of epidermophytosis.

2. Proper fitting of shoes which are broken in before attempting long marches. For wet winter climates, wear $\frac{1}{2}$ to $1\frac{1}{2}$ sizes larger than usual, with heavy woolen socks. Some form of insulating material in the winter boot would help. If no heavy wool socks are available, two pairs of winter-issue socks may be worn. The troops should have shoes or boots for winter service that are as nearly waterproof as possible and yet light enough for marching. None of the clothing should constrict circulation.

3. Change socks as often as possible. In damp weather, change them daily, washing one pair and drying it inside the jacket with body warmth if necessary.

4. A supply of clean socks is a command function. They should be supplied with the rations daily or every other day to front line troops when situated under conditions where they cannot wash their socks.

5. Commanding officers should see that troops are active on their feet at regular intervals of each day. When they are pinned down on wet ground by enemy fire for days, it is necessary to relieve them often enough to prevent irreparable damage, if at all possible. Most of these men developed trench foot with only five to seven days' exposure.

Trench foot or immersion foot resulting from inactivity during exposure to cold, damp weather is a serious problem. The men should be examined by a doctor who has had experience with this problem. Those with definite trench foot, grade I, mild, may be treated in a rest area. Some men need neuropsychiatric care most of all. The bulk of neuropsychiatric patients who do not have trench foot and those with it whose major problem is psychiatric can be treated earlier, before fixation on the trench foot has occurred, if a consulting psychiatrist is employed in the forward hospitals and clearing stations to help sort them out efficiently. A few need only strong reassurance and return to duty. Grades I, II, III, and IV cases should all be hospitalized where the above treatment can be carried out.

All patients with trench foot should go through a rehabilitation period of at least two weeks of daily hikes before returning to duty. The hikes are conducted by an officer patient or ward man and are gradually increased from $\frac{1}{4}$ to 5 miles in the first week.

The total number of cases hospitalized in this theater alone represents a great loss of man-hours and a permanent loss of some of the trained, experienced men in combat and service organizations.

Of 351 patients treated in this hospital, 23 were sent to the zone of the interior, 24 to permanent limited duty, 12 to temporary limited duty, and 292 to full duty. An average of sixty days in the hospital was required. Thus, 21,270 man-days were lost because of trench foot and its complications, not counting the time of some patients readmitted to hospitals in North Africa and the zone of the interior.

Complications of Primary Atypical Pneumonia

LIEUT. COLONEL CHARLES S. HIGLEY

Medical Corps, Army of the United States

MAJOR HARRY A. WARREN

Medical Corps, Army of the United States

and

CAPTAIN RICHARD S. HARRISON

Medical Corps, Army of the United States

Primary atypical pneumonia, etiology unknown, is generally considered to have a lower incidence of complications than other forms of pneumonia. While many reports mention the absence of complications, there are few which point out the actual incidence of complications in this disease.^{1 2 3} However, in a recently published survey⁴ of 493 cases, 178 cases showed complications of varying degree. The cases of primary atypical pneumonia treated at the station hospital, Truax Field, Madison, Wisconsin, between September 1942 and June 1943 have been reviewed to determine the incidence of complications observed at this hospital.

DIAGNOSTIC CRITERIA

All cases in our series were closely scrutinized and only those satisfying all of the following criteria for the diagnosis of primary atypical pneumonia, etiology unknown, were included.

Radiologic evidence. Definite evidence of pneumonic consolidation by x-ray was required. The roentgenologic findings in primary atypical pneumonia are extremely variable. We found that the only valid point in differential diagnosis is the patchy character of the lesion as distinguished from the more uniform ground-glass type of density seen in pneumococcal pneumonia. Every imaginable distribution of the lesions of

1. Dingle, John H., et al.: Primary Atypical Pneumonia, Etiology Unknown, *War Medicine*, 3:223-248, March 1943.

2. Reimann, H. A.: Viral Pneumonias, *Bull. N. York Acad. M.*, 19:177-182, March 1943.

3. Campbell, Thomas A., Strong, P. S., Grier, G. S., and Lutz, R. J.: Primary Atypical Pneumonia, *J. A. M. A.*, 122:723-730, 10 July 1943.

4. Van Ravenswaay, A. C., et al: Clinical Aspects of Primary Atypical Pneumonia, *J. A. M. A.*, 124:1-6, January 1944.

primary atypical pneumonia has occurred, from cases with evidence of scattered lesions resembling, remotely, submiliary tuberculosis throughout both lungs, to cases in which a single patch 1 cm. in size was observed above the dome of the diaphragm. There were some cases in which we were unable to make a differential diagnosis roentgenologically.

Laboratory evidence. The most important laboratory finding was the absence of a predominant organism which could be demonstrated in the sputum by typing or culture. The sputum is usually nonbloody and frothy. Bloody sputum was present in only 17 of our 480 cases. Only moderate elevation of the leukocyte count was acceptable, and if more than 10,000 a diagnosis of atypical pneumonia should be seriously doubted.

Clinical evidence. The typical clinical course is characterized by a gradual onset. Herpes, cyanosis, or extreme toxicity, are usually absent. Temperatures range from normal to 105°. Physical signs in the chest range from a few localized rales to signs of massive involvement of both lungs.

The 480 cases in our series which satisfied the above criteria, we feel, can accurately be diagnosed as true primary atypical pneumonia. During the same period, we observed an additional 40 cases of pneumococcal pneumonia and 65 cases of primary pneumonia, type undetermined, a total of 585 cases of pneumonia of all types.

Complications of varying severity were observed in 202 cases or 42 percent of our series. The complications fell into three groups (table I), those involving the lungs, those involving the pleural cavity, and those consisting of other diseases appearing during the course of the pneumonia as probable sequelae. Three patients died.

PULMONARY COMPLICATIONS

Relapses involving new areas of lung or reinvolvement of previously affected lobes occurred in 37 cases. Many of these occurred after an apparently normal regression of the disease during convalescence. In some cases, several weeks had elapsed and the patient had returned to duty; in other patients the relapses occurred shortly after regression of the original infection. In these, involvement of other areas of the lung appeared at a time when the primary area showed almost complete clearing.

An element of atelectasis probably is present in most, if not all, cases of primary atypical pneumonia. In the majority

of our cases, there were no criteria which permitted distinguishing between loss of air due to the presence of exudate in a small patch of lung and loss of air in a small group of alveoli associated with obstruction to a very small bronchiole. In eleven cases, however; definite roentgenologic evidence of atelectasis was present. In some cases a relatively small area of lung was involved, manifested by a ragged strip of greater density than that of the pneumonic lesion which cleared less rapidly than the pneumonia lesion proper. In other cases a

TABLE I
Summary of complications

	Number	Percent
Uncomplicated cases	278	58.0
Total complicated cases	202	42.0
Pulmonary complications:		
Recurrence	37	8.0
Atelectasis	11	2.0
Bronchiectasis	4	0.8
Lung abscess	3	0.6
Thin-walled cavitation	5	1.0
Delayed resolution (over three months)	8	0.6
Pleural complications:		
Pleurisy as evidenced by pleuritic pain	93	19.0
Pleural effusion	11	2.0
Residual pleural thickening	7	1.5
Empyema	4	0.8
Pneumothorax	2	0.4
Other diseases as sequelae:		
Bronchial asthma	16	3.0
Tonsillitis	6	1.0
Otitis media	8	2.0
Arthritis, nonpurulent	2	0.4
Herpes simplex	4	0.8
Pericarditis	1	0.2
Bell's palsy	1	0.2
Brain abscess	1	0.2
Deaths	3	0.6

whole lobe was atelectatic with the characteristic findings on x-ray examination. The cases with atelectasis usually cleared slowly with the aid of postural changes and similar treatment. In no case was bronchoscopic drainage resorted to.

Bronchiectasis, proved by iodized oil bronchograms, occurred in four cases. The recurrence of pneumonia in the same area should raise the suspicion of an underlying bron-

chiectasis and all four cases gave a history of more than one attack of pneumonia. The differentiation may be difficult to make between "pseudo" bronchiectasis developing during the course of pneumonia as described by Blades and Dugan⁵ and a pre-existing mild bronchiectasis which is the soil for the implantation of a fresh pneumonia. However, as we obtained a previous history of cough and expectoration in these cases, it was concluded that bronchiectasis had been present before the onset of pneumonia.

Purulent lung abscess with foul sputum and x-ray evidence of abscess occurred in three cases, two terminating fatally. In one case there were multiple lung abscesses in the left upper lobe with clubbing of the fingers and toes. In one fatal case, staphylococcus was cultured from the cavity.

THIN-WALLED CAVITATION

An area of translucency was found in five cases in the center of the pneumonic density on roentgenologic examinations. We called this "thin-walled cavitation." The findings were relatively uniform and in four cases concerned the right upper lobe; in the fifth case the central part of the right middle lobe was involved. In all cases there was a moderately large irregular patch of pneumonic consolidation in the center of which a circular translucency was observed. The translucency measured about 2 cm. in diameter and contained a fluid level. A well-defined wall to the translucency was absent. Repeated sputum examinations ruled out tuberculosis and other chronic pulmonary infections. The clinical course of these cases was uniformly benign and undistinguishable from cases in which these roentgenologic signs of excavation were not present. We do not regard these thin-walled cavitations as of serious significance. It is well known that the infiltrative lesions of primary atypical pneumonia mimic pulmonary tuberculosis. This lesion carries the similarity still further and the differential diagnosis is made largely by the benign course in atypical pneumonia. The illustrations show the course of such a lesion (figures 1, 2, and 3) and demonstrate how quickly and completely it may disappear.

Similar lesions have been described by Sante and Hufford⁶ in other types of acute pulmonary infection. They believe

5. Blades, Brian, and Dugan, David J.: Pseudo Bronchiectasis Following Atypical Pneumonia, *Bull. U. S. Army M. Dept.*, 70:60-68, November 1943.

6. Sante, L. R., and Hufford, C. E.: Annular Shadows of Unusual Type Associated with Acute Pulmonary Infection, *Am. J. Roentg.*, 50:719-732, December 1943.

that the explanation of this unusual lesion is septic infarction and that the chain of circumstances starts with the filling of terminal bronchioles, alveoli, and alveolar ducts by exudate. This causes obliteration of the terminal branches of the bronchial arteries, which are then plugged by septic thrombosis. Tissue necrosis and cavitation then follow in the area supplied by the vessel.

PLEURAL COMPLICATIONS

Pleural pain has been regarded as rare in atypical pneumonia. Sharp pain on inspiration with onset immediately preceding the pneumonia occurred in 93 cases or about 20 percent of our cases. Some were accompanied by pleural friction rub; in others no positive physical signs were noted.

Pleural effusion, usually unilateral, occurred in 11 cases. Diagnostic thoracentesis was done in most cases. In addition to this group, seven cases showed by x-ray residual pleural thickening after recovery

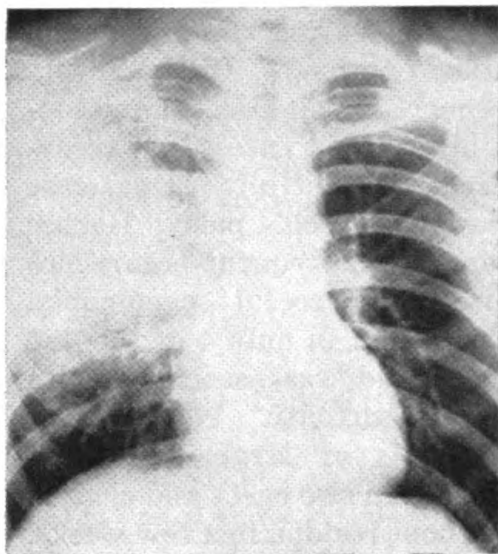


FIGURE 1. Extensive pneumonic involvement of the right middle and upper lobes on the fourth day of illness, 28 March 1943.

from the acute process.

Empyema requiring rib resection occurred in 4 cases. Three have shown complete recovery; one developed pericarditis during a prolonged illness, but eventually recovered. In 3 cases, streptococci were cultured from the empyema fluid, and in one case *Staphylococcus aureus*. Spontaneous pneumothorax occurred in 2 cases during the pneumonia, one on the same side as the pneumonic lesion and the other on the opposite side; in one case this hastened a fatal outcome.

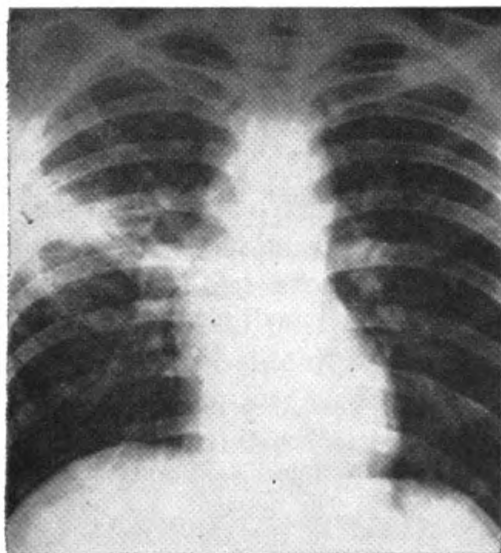


FIGURE 2. Thin-walled cavitation developing during resolution of pneumonic area, 8 April 1943.

OTHER COMPLICATIONS

Bronchial asthma of moderate severity appeared in 16 cases, in some of which asthmatic rales were heard over the entire lung, although no previous history of asthma was obtainable. In others a history of pre-existing asthma with reactivation during the pneumonia was obtained. Otitis media occurred in eight cases and tonsillitis in six cases. All recovered uneventfully. One case developed Bell's palsy. Herpes simplex, a frequent occurrence in pneumococcal pneumonia, was noted in only 4 of the 480 cases and was associated with severe toxicity. Nonpurulent arthritis of large joints appeared in two cases and cleared without residua in a few weeks.

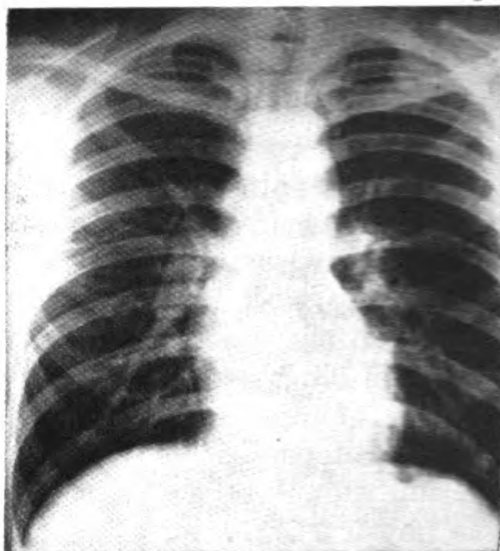


FIGURE 3. Spontaneous healing of cavity with slight residual fibrosis, 28 April 1943.

FATAL CASES

Three patients died because of complications.

CASE 1. A white male, 37, with a history of cough and malaise of gradual onset, was admitted to the hospital on 21 November 1942, with a temperature of 100.2° and a leukocyte count of 10,800. Sputum showed short-chain streptococci. Roentgenologic examination provided evidence of primary atypical pneumonia at the right base. The patient deteriorated slowly and developed empyema during the second week after admission. Fluid obtained by thoracentesis showed *Staphylococcus aureus* on culture. Lung abscess developed in the left lower lobe. Surgical drainage was performed and the patient seemed to improve, but metastatic abscesses developed in the brain. He died on 17 February 1943. Autopsy showed a lung abscess at the left base from which staphylococci were easily grown, bilateral adherent pleuritis, chronic nephritis, and multiple abscesses of frontal, temporal, parietal, and cerebellar lobes.

CASE 2. A white male, 21, was admitted on 8 November 1942, with cough and malaise, temperature of 102.2°, and 11,000 leukocyte count. Sputum showed no predominant organism. X-ray showed a 4-cm. shadow typical of primary atypical pneumonia at the right base. The patient did not respond to sulfonamide and developed lung abscess in the right lower lobe and later a bronchopleural fistula and pneumothorax. He died on 11 December 1942. Autopsy showed multiple abscesses of right lower and left upper and lower lobes, right hydropneumothorax, and acute toxic nephritis.

CASE 3. A white male, 19, was admitted on 24 October 1942, with general malaise, temperature 102°, and 11,000 leukocyte count. The chest was clear and the sputum showed no predominant organism. On the fourth hospital day, rales were heard at the right base, but his general condition was unchanged. On the ninth hospital day, he appeared worse and dullness was noted at the left base. X-ray showed consolidation of the greater part of both lungs. There was no response to sulfonamide or general supportive therapy and he expired on 15 November 1942. Autopsy showed extensive pneumonia of both lungs with left hydrothorax and cloudy swelling of both kidneys.

SUMMARY

Primary atypical pneumonia, while frequently mild and uncomplicated, may be accompanied by severe complications. It has a definite mortality. Complications of various types were found in 43 percent of 480 proved cases.

Footdrop Following Skeletal Fixation

CAPTAIN EMANUEL BLUMENFELD

Medical Corps, Army of the United States

In the treatment of fractures, mechanical skeletal fixation is being used with various modifications and increasing frequency. Few reports on cases treated by these methods have been made and mention of complications has been singularly lacking.¹ Two cases of footdrop in the treatment of leg fractures are reported here and a third case is mentioned to show how a similar occurrence was prevented by prompt removal of the Steinmann pin.

A soldier sustained a compound fracture of the shafts of the tibia and fibula. The wound on the anteromedial aspect of the mid leg was treated and then the dual pin units (older type Roger Anderson apparatus) were introduced in the proximal and distal portions of the tibia in the prescribed areas and in the lateral side of the leg. The fracture was reduced and the pins and leg were incorporated in a plaster of paris cast.

Thirty-three days later the patient had a temperature up to 103°, with pain in the groin; when the cast was removed, the source of the temperature appeared to be a cellulitis originating at the site of the upper of the lower two pins. Eleven

1. Bradford, C., and Wilson, P. D.: Mechanical Skeletal Fixation in War Surgery, Surg. Gyn. Obst., 75: 468-476, October 1942.

days later a small fluctuant swelling appeared on the antero-lateral aspect of the mid third of the leg opposite the region of the compound wound, which by now was completely healed. This abscess was incised and on probing could be traced to the upper of the lower two pin openings. Cultures revealed *Staphylococcus aureus* nonhemolyticus. The incised wound presented necrosis of the deep fascia and the muscles and tendons of the dorsal extensors of the foot and toes. The wound was packed wide open and subsequently healed by granulation during which time moderate amounts of necrotic muscle and fascia were removed at intervals. The pins were left in situ, however, and in eight weeks, when it appeared that union was sufficiently solid, they were removed. Bone infection was not present, and the patient developed firm bony union and has since been returned to duty. However, because of loss of anterior musculature, he had a footdrop.

The second case also had a fracture of both bones of the leg, but they were not compound. He was treated in the same manner as in the first case. On the day following reduction of the fracture, he had no active power in extension of the toes and foot and a small area of the sensory loss over the region of the big toe was noted, both indicating that the fibers of the deep branch of the common peroneal nerve were involved. The cause for this was not evident. Excessive traction was ruled out because the superficial peroneal nerve was involved. Consideration was given to an accidental direct trauma to the nerve fibers on introducing the pins or localized edema in the subcutaneous tissue following insertion. The fracture went on to clinical union. Eight weeks later, on removing the pins, two small ulcers were evident lateral to the crests of the tibia in its middle third. At first they were presumed to be the result of trophic skin disturbance secondary to nerve involvement, but several weeks later the discharge became foul smelling and small seepage arose from the scar of the lower of the upper two pin holes. Incision and drainage were performed, the two ulcers being connected and the drainage traced to the old pin hole. The wound appeared similar to that of case 1. Firm bony union occurred, but the footdrop remained. The wound gradually healed and the patient was returned to limited duty. Several weeks later, I saw this patient in a general hospital. He had a recurrence of drainage from the wound, and x-rays of the tibia were interpreted as indicating evidence of osteomyelitis. Surgical exploration failed to reveal evidence

of bone infection, the assumption being that all his difficulty lay in his soft tissue. He received parenteral and local penicillin therapy with subsequent healing of the wound. Now he is awaiting return to duty.

Following the second case of footdrop, we introduced our pins in the medial aspect of the leg wherever possible.

A third case with fracture of both bones of the leg and abrasions over the inner aspect prompted us to introduce the pins laterally. Three weeks later the patient complained of pain in the upper pin region and ran a temperature up to 102°. The cast was promptly removed and a small amount of purulent drainage came from the lower of the upper pins. A fluctuant mass also was present on the medial aspect of the leg in the same region. The pin was removed, the abscess incised, and a plaster of paris cast applied incorporating the knee and the ankle joint, the lower two pins, and the one remaining upper pin. The temperature gradually returned to normal, and the fracture went on to bony union. The patient is now awaiting return to duty.

The features common to the three cases were:

1. The pins were inserted on the lateral aspect of the leg through muscle and fascia into bone.
2. The fracture healed entirely aside from the infection.
3. The onset of the infection occurred several weeks after introduction of the pins, revealing that the infection was not immediately present and probably unrelated to a break in technique in inserting the pins.

Destruction of soft tissue occurred in cases 1 and 2 but was prevented in case 3 by the prompt removal of the pins.

In a recent article on the use of mechanical skeletal fixation apparatus,² this complication was not mentioned. Since all pin areas are more or less infected, the continual motion of the foot, ankle, and knee joints leads to irritation of the skin about the pins, especially where they are inserted in the lateral aspect of the leg. Bacteria get into the subcutaneous tissue and move up and down, laying the seed for more extensive involvement. Since these patients are encouraged to get out of bed and move the joints adjacent to the fracture, this spread is enhanced.

2. Mazet, R., Jr.: The Use and Abuse of the Anatomic Splint in the Treatment of Fractures of the Lower Extremity, *J. Bone Surg.*, 25: 830, October 1943.

In the light of these experiences it is suggested, if pins are used, they be introduced on the medial aspect of the leg wherever possible. The anteromedial aspect of the tibia is bare of muscle and is directed obliquely, so the pins in no way interfere with ambulation and do not come in contact with the opposite limb. Secondly, whenever the patient complains of severe pain in the pin region, associated with more than a slight rise in temperature which cannot be attributed to reasons outside of his local pathology, the offending pin or pins should immediately be removed and another form of treatment substituted. Finally, it probably would be wiser with respect to any patient who postoperatively presents sensory and motor difficulty, especially involving the peroneal nerve, to remove the upper pins in order to avert permanent neurological damage.

SUMMARY

In two cases of footdrop using the dual pin units of the Roger Anderson apparatus in fractures of the tibia and fibula, the cause appeared to be the use of pins through soft tissue into bone, free motion of the joints adjacent to the pins, and the spread of infection up and down fascial planes with the production of a severe delayed cellulitis. This was prevented in a third case by the prompt removal of the offending pin.

Footdrop might be avoided by inserting pins into the anteromedial aspect of the tibia whenever possible and by immediate removal of a laterally placed pin when elevated temperature or severe pain in the pin region develops after an interval of comfort and freedom from temperature.

Direct trauma to branches of the common peroneal nerve in inserting the pins on the lateral side should not be disregarded and paresthesias along the sensory distribution of this nerve, as well as loss of active dorsiflexion of the foot and toes, should call for prompt extraction of the upper pin or pins.

Athletic Contests and the Greek Nation.—After the Dorian invasion, about 1100 B. C., the history of Peloponnesus, the southwest division of Greece, was dominated by the rise of the great religious festivals and their athletic contests at Olympia, Nemea, the Isthmus, and Argos. The Olympic games in particular were not merely a Dorian but a Panhellenic festival as they perhaps gave the first impulse to the idea of a Greek nation. These festivals provided Greek history with its first reliable chronology and set the pattern for future athletic contests all over the world.

Adjustable Acrylic Mouth Prop

CAPTAIN MARVIN G. FREID

Dental Corps, Army of the United States

The presence of trismus affords various problems incident to the treatment of facial injuries. The following is the report of a case wherein the trismus posed an unusual problem.

A French Senegalese soldier was admitted to the hospital with a penetrating wound of the left thigh. On the fifth day following the injury, the patient developed tetanus. Because of the prophylactic use of tetanus toxoid, this condition has been extremely rare in our Army. No clear history could be obtained in this case as to whether this man had received any toxoid previous to being wounded. On admission to our hospital, he received a stimulating dose of toxoid on the supposition that he had previous antitetanus therapy.

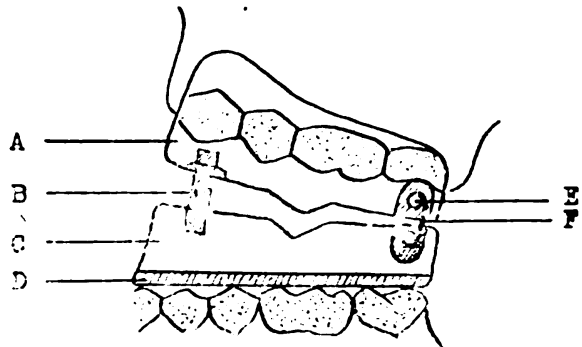
A dental problem manifested itself soon after the onset of tetanus. Spasmodic contraction of the masticatory muscles had caused the patient to lacerate his tongue, deep ulcerations covering its dorsum and sides. The resulting edema of the entire tongue caused it to protrude about one-half inch out of the mouth. Each additional spasm would have resulted in further injury to this organ if the teeth had not been prevented from coming into occlusion. The need for the immediate insertion of a permanent form of mouth prop was recognized. To keep the teeth apart until such a prop could be made, an improvised gag was fashioned by fastening six tongue depressors together with adhesive tape. This was inserted between the teeth and held in place by a corpsman who was in constant attendance on this patient.

The patient was given 50 gr. of sodium amytal intravenously to sedate the patient and allow for relaxation of the involved muscles. This tremendous dosage was necessary to bring about the desired result. The jaws were then forced open about an inch by means of a Denhart mouth gag. The edematous tongue filled the entire oral cavity; however, a compound impression was secured in a simple bridge tray. The impression included both premolars and the first and second molars of the upper jaw on the left side. This side was chosen because it was lacerated less than the right. No attempt at a lower impression was made, as it was not necessary to use a model of the lower teeth. A stone model was poured in this compound impression and, after separation, the prop was waxed onto the cast in the following manner:

Lieut. Colonel Dennis D. Glucksman aided in the preparation of this paper, and Technician Third Grade Edward Irwin made the sketches.

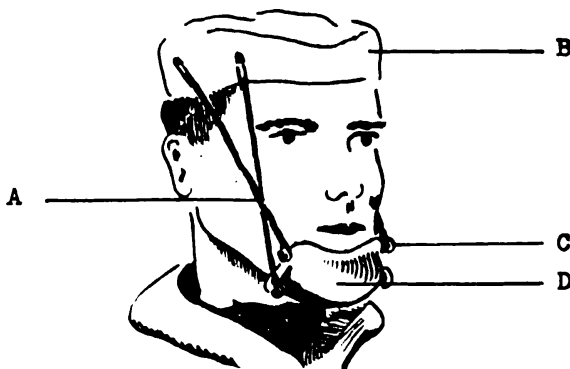
The teeth were covered with three layers of 0.001-inch tinfoil and a block of wax placed over it. The wax extended over the buccal surfaces of the teeth and almost to the mucobuccal fold. On the lingual, the wax extended just beyond the gingival margin of the teeth. The wax was built to a thickness of one-half inch in the anterior, reducing to one-quarter inch in the posterior, forming a bite-block. A layer of foil was then laid over this and a block of wax of similar height was added to fit against the occlusal surfaces of the lower teeth. The under surface of this lower section was countersunk to accommodate a soft rubber pad. A curve of Spee of about 15 degrees was followed. The prop was then processed in two pieces.

To make the prop adjustable, a screw and a nut were incorporated in it. The nut was buried in the upper section of the prop anteriorly with the outer surface even with the lower border of the bite-block. A nail was placed from the nut in the upper into the wax in the lower section so that a place for the screw would be left in the processing of the acrylic. Afterwards, the nail was removed and the screw substituted. A hole was drilled into the body of the screw so that an instrument fitting into it could be used as a wrench to turn it.



Finished prop cemented into place: A, upper section of prop; B, adjustable nut and screw; C, lower section of prop; D, rubber pad cemented into countersink; E, screw-head; F, spring formed by 0.036-in. chrome steel wire.

The upper and lower sections of the prop were held together posteriorly by means of a spring formed from 0.036-in. chrome steel wire. This was countersunk into the acrylic so



Chin cup in place: A, rubber dam strips; B, head cap; C, projecting knob; D, chin cup.

that it would not lacerate the cheek. It was attached to projecting screw heads. A pad of soft rubber tubing cut to fit was cemented to the countersink in the lower section of the prop. After trying the prop in the mouth to decide the degree of opening needed, it was cemented to the upper teeth. The lower teeth occluded into the soft rubber on the underside of the lower section on the prop.

If a wider opening should be desired, this can be accomplished by turning the screw, thus increasing the distance between the teeth, or, as the spasms lessen and the edema in the tongue recedes, the opening can be reduced. This gives a sturdy adjustable prop that is not irritating and can be made in very little time.

USE OF ACRYLIC CHIN CUP IN SUBLUXATION OF MANDIBLE

As the patient improved, the muscles of mastication relaxed to a great extent; however, some spasmodic contractions still remained. This took the form of forcing the jaw forward, resulting in a subluxation of the mandible, which was very painful.

Radiographs of the temporomandibular joint on both sides revealed that no dislocation was present but that the heads of the condyles were forced forward out of the glenoid process until they touched upon, but did not go beyond, the eminentia articularis. To replace and maintain the condyles in their proper position, the following procedure was followed. A chin cup with four projecting knobs was processed in acrylic. These knobs projected laterally about one-half inch to allow the elastics to clear the face.

An operating cloth head cap was reinforced with adhesive tape. The plan was to have the chin cup held in place by means of elastics attached to the head cap. The pressure would be directed backward and upward to force the mandible into position and to retain it there.

The patient was given 15 gr. of sodium amytal intravenously to relax the muscles. Then the jaw was manipulated by hand until the condyles were forced back into the glenoid fossae and the teeth occluded normally. A fair amount of force was required to return the mandible to its normal position. While the mandible was held in this position, the head cap and chin cup were applied, being connected by elastics formed from strips of rubber dam. This held the teeth in occlusion and prevented the recurrence of the subluxation.

When the patient's general condition warrants it and the subluxation has not entirely disappeared, the teeth may be wired together and the cup removed. At this writing, the patient is improving rapidly.

Wounds of the Extremities.—Reports by medical officers to The Surgeon General indicate that, despite the increased ferocity of the present war, the number of wounds of the arms and legs—major injury in battle—is no greater than in other wars in American history. Wounds of the extremities constituted 70.8 percent of all combat injuries in the Civil War and 76.5 of combat wounds in the World War. In the present war, 70 percent of all battle wounds are wounds of the extremities.

Infectious Mononucleosis

Study of Twenty-nine Cases

CAPTAIN WILLIAM H. WALKER

Medical Corps, Army of the United States

Infectious mononucleosis was described as a clinical entity by Emil Pfeiffer in 1889.¹ Since then numerous sporadic and epidemic forms of the disease have been reported among children and adults throughout the world. Although absolute proof is lacking, it appears that a virus is the infective agent^{2 3} and that the incubation period varies from one to twenty-eight days. Tidy,⁴ Bernstein,⁵ and Sundberg⁶ have published reviews of the subject. Among the peculiarities of infectious mononucleosis is its protean character in mode of onset, severity symptomatology, and variable physical findings and clinical course. Its manifestations show a variety of patterns, and a true diagnosis may not be appreciated until a considerable portion of the clinical course unfolds. An appreciation of these facts is essential to an early diagnosis.

This report concerns a study of 29 cases of infectious mononucleosis admitted to the Station Hospital, San Antonio Aviation Cadet Center, San Antonio, Texas, from 18 May 1942 to 7 June 1943. The author cared for personally or was consulted regarding all but the first two patients treated.

The patients were white males varying in age from 20 to 28 years. Seventeen were aviation cadets from all parts of the United States. With few exceptions all became ill within a few days to a few weeks after assuming their duties here. None had recent serum injections. There was no history of contact with or of having had glandular fever. The diagnoses on hospitalization were tonsillitis or pharyngitis, 19; influenza, 2; primary atypical pneumonia, 2; "observation," 1; cervical adenitis, 2; and infectious mononucleosis, 3.

Bernstein pointed out that infectious mononucleosis has no definite seasonal incidence. The case distribution by months and clinical types in the present study is shown in table I. The increased incidence of cases in the last few months apparently is due to a more thorough knowledge of the clinical patterns of glandular fever.

1. Pfeiffer, E.: Drusenfieher, *Jahrb. f. Kinderh.*, 29:257, 1889.

2. Barber, H. S.: Anginose Glandular Fever, *Lancet*, Lond., 1:71, 1941.

3. Zohman, B. L., and Silverman, E. G.: Infectious Mononucleosis and Encephalomyelitis, *Ann. Int. M.*, 16:1233, 1942.

4. Tidy, H. L.: Glandular Fever and Infectious Mononucleosis, *Lancet*, Lond., 2:180 and 236, 1934.

5. Bernstein, A.: Infectious Mononucleosis, *Medicine*, Balt., 19:85, 1940.

6. Sundberg, D.: Infectious Mononucleosis, *Detroit Medical News*, Educational Issue, 32:29, 1941.

CLINICAL VARIETIES

To emphasize the variety of initial symptoms and physical findings, six different clinical types under which this series of cases may be classified have been chosen. Although overlapping of symptoms and findings was evident in the group as a whole, certain characteristics of individual cases made possible a subdivision of patients. Certain symptoms, however, were common to nearly all cases. These complaints varied in severity and duration, appeared in the first week of illness, and in most instances responded slowly to supportive therapy. Such features were headache, malaise, weakness, fever, chilliness, sore throat, anorexia, and excessive perspiration.

TABLE I
Distribution of cases by months and primary clinical types

Month	Number cases	Respiratory	Febrile	Lymphadenopathy	Exanthemata	Central nervous system	Gastro-intestinal
18 May 1942	1	1	0	0	0	0	0
October	1	0	0	0	0	0	1
December	1	1	0	0	0	0	0
January 1943	2	2	0	0	0	0	0
February	8	3	1	2	0	2	0
March	9	5	2	0	1	0	1
April	2	2	0	0	0	0	0
May	3	3	0	0	0	0	0
June 7	2	1	0	1	0	0	0
Totals	29	18	3	3	1	2	2

1. *Respiratory.* Eighteen patients were placed in this category. Common to this group were one or more of the following: sore throat, dry or productive cough, and substernal chest pains. The patient's throat is injected and a variable degree of edema secondary to lymphoid hyperplasia and infection may be noted. One or both tonsils or remaining lymphoid tissue is enlarged and tender, with yellow or white exudate peppered over the surface. Such infection clears more slowly than the uncomplicated case of pharyngitis or tonsillitis and not infrequently is subject to recurrence.

Bleeding secondary to Vincent's angina and stomatitis may confuse the underlying disorder. Such infection requires immediate dental hygiene and, even where complicated by a coexistent bacterial infection, the stomatitis has responded

promptly to treatment in all such cases. In 12 patients of this group, throat smears and cultures revealed the following: fusiform bacilli and spirilla alone, 6, and in combination with hemolytic *Staphylococcus aureus* and/or hemolytic *Streptococcus*, 3. In two cases, hemolytic *Staphylococcus aureus* was cultured from tonsillar exudate; in another, hemolytic *Staphylococcus aureus* and hemolytic *Streptococcus*. The latter along with one of the Vincent's cases each developed a benign, small, deep, punched-out ulcer in the throat, apparently secondary to necrosis of the lymphoid tissue.

One to three x-rays of the lungs were obtained during the clinical course of 14 patients. All were normal except for transient left hilar lymphadenopathy in one patient.

2. *Febrile*. This group is difficult to differentiate from the respiratory. Occasionally, the fever precedes and is far out of proportion to the degree of upper respiratory disease. The clinical course reveals from onset shaking chills every one to three days, hectic or irregular temperature rising to 103-105 degrees daily and severe headaches and prostration. Such a course has persisted for from ten days to more than three weeks in the 3 patients placed in this group. Of the remaining 26 cases, 3 were afebrile during the entire clinical course, 9 suffered peak elevations from 99-100 degrees daily for from two to four days, and 14 revealed a prolonged low grade temperature or a few days of spiking fever, subsiding by lysis in seven to ten days.

3. *Lymphadenopathy*. Rarely was lymphadenopathy the predominant feature. Although it was one of the chief complaints in eight patients, in but three instances did generalized enlargement of the lymph nodes overshadow concurrent manifestations such as chills, fever, and respiratory infection. Although general lymphadenopathy is one of the most constant features of infectious mononucleosis, it is not a requisite of the disease. Such nodes are usually non-tender, discrete, firm, movable, and regular in outline. They may be equally enlarged in all sites yielding to palpation, but asymmetrical enlargement is more usual. Adenopathy may appear at any time in the course of illness, but usually is noted in the first week. Enlargement progresses rapidly in two to four days but subsides slowly. Favorite sites for marked lymph node enlargement are the neck, axilla, and groin, in order. The greater frequency of early and prominent increase in size of the tonsillar nodes is apparently related to the concomitant early appearance of follicular pharyngitis or tonsillitis.

Splenomegaly is a constant but not essential finding in glandular fever. Palpable enlargement varies, no doubt, with the efforts and persistence of the examiner to elicit this sign. In this series splenic enlargement appeared usually from the third to seventh day of illness, and was present in 25 of the 29 patients. Duration of enlargement paralleled closely the extent to which the organ increased in size. In no case did the spleen reach more than 4 cm. below the left costal margin in the anterior axillary line.

4. *Exanthemata*. A skin eruption is not uncommon. It is reported to occur usually within the first three weeks of illness.⁷ In epidemics the incidence may approach 100 percent.⁴ There is no characteristic exanthem of glandular fever. The various types reported include petechial, purpuric, vesicular, urticarial, erythematous, macular, and maculopapular.

Among the 29 cases, 6 had skin manifestations. One of these and two others had a petechial enanthem of the buccal mucous membranes and pharynx. A recurrent scarlatiniform eruption which could not be ascribed to drug therapy was noted in one patient, and a diagnosis of scarlet fever was entertained momentarily. Another of these 8 patients was diagnosed as also having German measles, an impression with which the author did not concur. In spite of a 27.6 percent incidence of exanthem and enanthem, only one case showed a rash to be the outstanding clinical feature.

TABLE II

Skin and mucous membrane manifestations, with concurrent laboratory data, in 8 cases of infectious mononucleosis

Case No.	Clinical type	Exanthem			Enanthem	Leukocytes			Paul-Bunnell test
		Types	Distribution	Days of illness		Total	Percent lymphs	Blood smears	
61627	Gastro-intestinal	Vesicular	Trunk	16-7	No	12,650	67	Pos.	Neg.
63815	Respiratory	Purpuric; petechial	Conjunctivae, trunk, upper arms, legs	21-24	Yes	37,350 to 20,650	34 to 63	?	1:640
66105	Respiratory	Erythema; papular	Not specified	26-28	No	4,650	46	?	Neg.
67906	Central nervous system	Morbilliform	Upper arms, legs, trunk	20-25	No	16,900	71	Pos.	1:1280
68530	Febrile	Punctate; erythema	Trunk axillae, groins	20-23, recurred 31-34	No	6,500 10,700	65 45	Pos.	1:640 1:320
68839	Exanthem	Petechial	Axillae, right arm, abdomen, thighs	3-6	No	5,000	51	Pos.	Neg.
70929	Respiratory	None	—	—	Yes*	16,650	77	Pos.	1:640
72485	Respiratory	None	—	—	Yes**	13,250	72	Pos.	1:320

*From 7-12 days of illness. **From 12-15 days of illness.

Sadusk⁸ reports a false positive syphilis serology in four cases with skin eruptions. Apparently the frequency of this finding is in direct proportion to the number of tests done and occurs less commonly in cases without exanthemata.⁸ The only case with a false positive Kahn in this report had a rash and enanthem. However, serial serological studies were not done in other cases. A tabulation of clinical and laboratory data relative to these 8 patients appears in table II.

5. *Central nervous system*. The neurological manifestations of infectious mononucleosis are variable³ and were benign and

7. Templeton, H. J., and Sutherland, R. T.: Exanthem of Acute Mononucleosis, *J. A. M. A.*, 113:1215, 1939.

8. Sadusk, J. F.: The Skin Eruption and False-Positive Wassermann in Infectious Mononucleosis, *Internat. Clin.*, 1:239, 1941.

transitory among the cases in this report. Headache was common to nearly all victims for a few days early in the disease. One or more of the following findings was of transitory duration in 4 patients: confusion, dizziness, nystagmus, sensation of impending syncope, and diplopia. Because of persistent headache 2 of the 4 are presented as possible central nervous system types of glandular fever. One of these was subjected to lumbar puncture in the fifth week of illness, but spinal fluid cytological, biochemical, and serological studies were normal. The headache was not relieved by the procedure and no other etiological factors could be found.

Cases are reported in which the neurological picture is more profound and severe, although apparently no death has resulted.⁵ Such patients may present a variety of findings that point to meningeal, cerebral, or cerebellar involvement. In some instances the spinal fluid pressure may be elevated. The protein and cells may be increased, although the latter has been noted in absence of neurological manifestations.⁹

6. *Gastro-intestinal.* Occasionally the prodromal symptoms and clinical course of infectious mononucleosis are referred to the abdomen and gastro-intestinal tract. Confusion may arise because the disease simulates appendicitis, acute gastro-enteritis, or the enteric fevers; and such cases have been subjected to surgery.¹⁰ In over a third of West's cases enlarged mesenteric nodes were palpable.¹¹ Poppel and Starr report a case in which transient, extrinsic pressure defects were demonstrated in the small and large gut by barium studies.¹² Abdominal pain is a sequel to the mesenteric adenitis. Clinical jaundice appeared in 7 of 20 cases reported by Kilham and Steigman. The urine was positive for bile and a direct Van den Bergh was obtained. A punch biopsy of the liver revealed evidence of focal, acute hepatitis in one patient.

Two patients in the author's series were clinically of the gastro-intestinal type. One suffered anorexia, abdominal cramps, and diarrhea; the other had nausea, vomiting, and persistent left upper quadrant abdominal pain. The latter symptom was present also in three other patients and in all was apparently due to splenomegaly. Jaundice was not observed in this series.

LABORATORY DATA

Two clinicopathologic features of glandular fever are of diagnostic assistance; namely, the "atypical" lymphocyte^{13 6} and the Paul-Bunnell heterophile antibody test.¹⁴ It is stated that both are essential to the diagnosis of infectious mononucleosis,⁹

9. Kilham, L., and Steigman, A. J.: Infectious Mononucleosis, *Lancet*, Lond., 2:452, 1942.

10. Gooding, S. E.: On Glandular Fever or Infective Mononucleosis, *Practitioner*, Lond., 127:468, 1931.

11. West, J. P.: An Epidemic of Glandular Fever, *Arch. Pediat.*, N. Y., 13:889, 1896.

12. Poppel, M. H., and Starr, S.: Roentgen Manifestations of Acute Infectious Mononucleosis in the Abdomen. *Radiology*, 39:437, 1942.

13. Kracke, R., and Garver, H.: Diseases of the Blood and Atlas of Hematology, p. 381. Philadelphia: J. B. Lippincott Co., 1937.

14. Haden, R. L.: Principles of Hematology, p. 117, 2d ed. Philadelphia: Lea and Febiger, 1940.

but there are reports to the contrary.^{15 16 17 18} The atypical lymphocyte (Kracke type 1)¹³ has been noted in variable numbers in the laboratory in apparently normal patients, in lymphatic leukemia, and in numerous infections.

Sheep cell agglutinins are present in low concentration in normal human sera.^{19 20} Higher values may be found in patients recently subjected to serum therapy or suffering serum sickness.^{15 21} In the absence of serum therapy or serum sickness, a positive Paul-Bunnell test in dilution of 1:64 or more is strong evidence of infectious mononucleosis.¹⁹ Guinea pig kidney absorption studies should be performed where coexistent serum reaction and glandular fever are suspected, or where the differential diagnosis is between the two states. Serial white and differential counts were done in all cases and periodic heterophile titers were determined as soon as the disease was suspected. These studies reveal that the atypical lymphocyte appears in the first two weeks of the disease, but not in considerable numbers before the first five to seven days. In two of three cases with negative heterophile antibodies in the first week of illness (less than 1:20 dilution), blood smears revealed numerous atypical lymphocytes. The Paul-Bunnell test in both became positive in the second week.

Eight patients were seronegative. This fact can be accounted for here when one considers that the sheep cell agglutinins reach a peak rapidly, usually in the first week or two of the disease, and either disappear just as rapidly or subside gradually (figure 1). It is important, therefore, to perform this test at least three times weekly from the end of the first to the fifth weeks where an unequivocal diagnosis is desired. Rarely, more delayed reactions may occur but were not encountered in this report. Failure to obtain a positive test results because the disease is not suspected in its early stages or the test is not performed at intervals sufficiently frequent to include what may be a short interval of positive titer. Technical details should be followed closely.^{22 14} In this series the test¹⁴ was run in every case against a positive control serum of known sheep cell agglutinin titer. The latter does not lose its potency when stored and refrigerated properly.^{5 23}

15. Davidsohn, I.: Serological Diagnosis of Infectious Mononucleosis, *J. A. M. A.*, 108:289, 1937.

16. Diasio, J. S.: Infectious Mononucleosis; Report of Two Unusual Cases, *Mil. Surgeon*, 90:647, 1942.

17. Magner, W., and Brooks, E. F.: Infectious Mononucleosis with Acute Thrombopenic Purpura, *Canad. M. Ass. J.*, 47:35, 1942.

18. Warren, E. W.: Observations on Infectious Mononucleosis, *Am. J. M. Sc.*, 201:483, 1941.

19. Smeall, J. T.: Glandular Fever (Infectious Mononucleosis), *Edinburgh M. J.*, 49:291, 1942.

20. Strauss, R., and Bernstein, M. T.: Further Serological Studies in Infectious Mononucleosis, *Am. J. Clin. Path.*, 12:174, 1942.

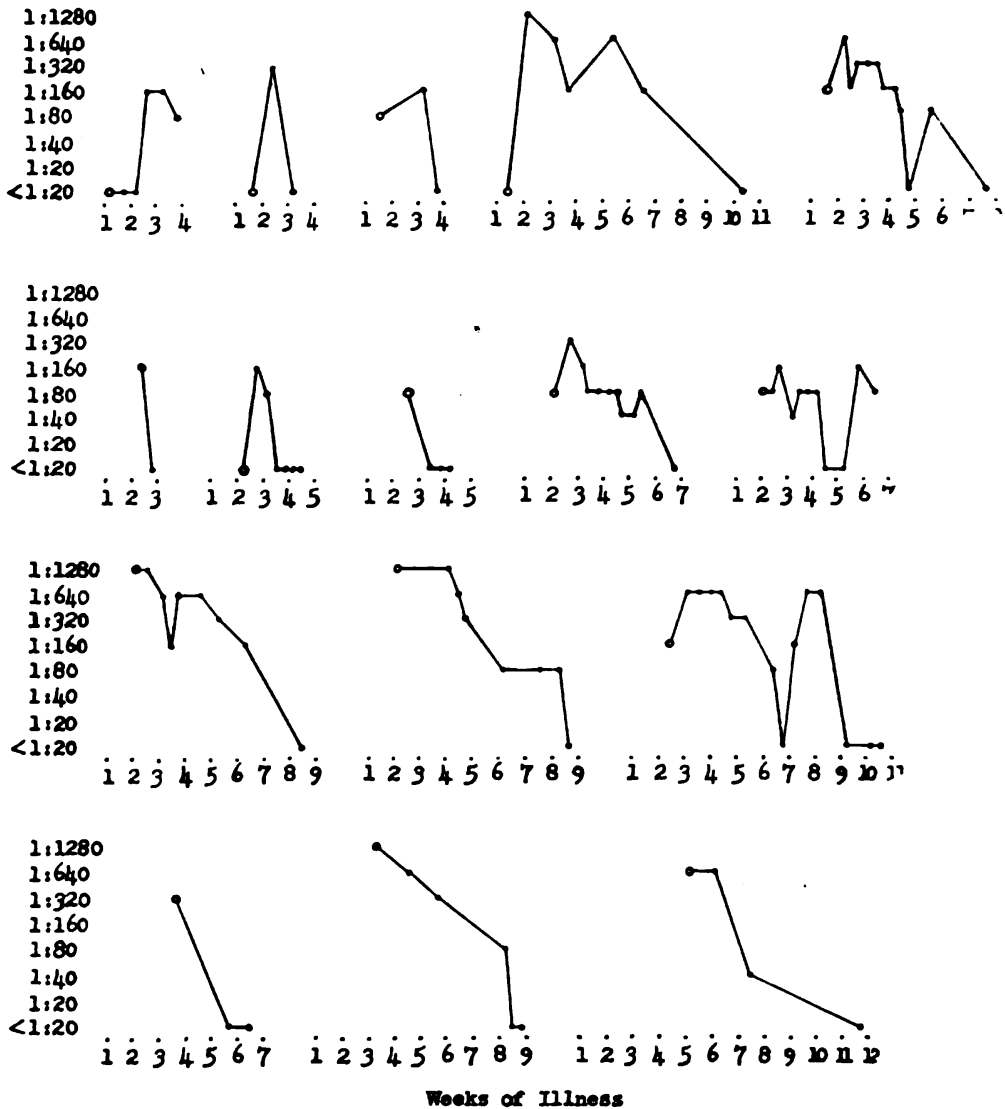
21. Paul, J. R.: Infectious Mononucleosis, *Bull. N. York Acad. M.*, 15:43, 1939.

22. Barrett, A. M.: The Serological Diagnosis of Glandular Fever (Infectious Mononucleosis): A New Technique, *J. Hyg., Lond.*, 41:330, 1941.

23. Werlin, S. J., Dolgopol, V. B., and Stern, M. E.: Infectious Mononucleosis—Diagnostic Problem, *Am. J. M. Sc.*, 201:474, 1941.

Of the 21 patients showing a positive Paul-Bunnell test, 3 of the 6 examined during the first week of illness gave a negative result. Only one of the eleven first titers taken in the second week was negative, while three were highly positive in the third week. In one patient the first heterophile test was done in the fifth week and found positive.

Fig.1 Serial Heterophile Antibody Study in 16 Cases
(Performed Through 1:1280 Dilution)



The graphic trend of the heterophile agglutinins in each of 16 patients is shown in figure 1. No definite relationship of titer levels to degree or type of illness or lymphocytosis could be found, although complications of respiratory infections and protracted debility appeared to be more prevalent among patients with prolonged lymphocytosis and high agglutinin titer.

Twenty-two patients were hospitalized during the first week of illness. Although 4 of these showed admission leukocyte counts of less than 6,000, variations from 5,000 to 23,600 occurred. Admission differential counts revealed a granulocytopenia in one of the four cases with leukopenia. A relative and/or absolute lymphocytosis was noted in 14 of the 22 subjects, but admission lymphocyte percentage fluctuated from 13 to 90 in the 22 patients. Total leukocytes on admission among the four patients hospitalized in the second week of illness varied from 7,000 to 14,850, with 37 to 91 percent lymphocytes. Two were admitted in the third week and one in the fourth week of illness, with initial white cells numbering 16,400, 14,400, and 4,600, respectively. Corresponding lymphocytes were 15, 26, and 68 percent. During the course of the disease a leukocytosis was noted in 27 of the 29 subjects. Fourteen had counts of greater than 15,000. Of these, three reached levels of 30,000, 30,450, and 37,400, respectively. A maximum lymphocytosis ranging from 50 to 91 percent was present in 26 cases, in half of which it was greater than 75 percent. Eight patients had leukocyte counts of less than 6,000, occurring at no definite stage of the disease. Ten of 14 uncomplicated, heterophile-positive cases had normal leukocyte counts at hospital discharge. This represents from the 5th to the 53d day of illness in this group, the mean being 32 days. Of the remaining 4, white counts remained elevated at the 20th, 24th, 27th, and 60th days, respectively. Fifty percent of each group had greater than 40 percent lymphocytes at discharge.

Thrombocytopenia may occur in glandular fever with or without clinical manifestations, and hemorrhagic phenomena are reported in the presence of normal platelet counts. In this series one subject had a small, spontaneous hemorrhage from the right lower gum margin on the fifteenth day of illness. Although bleeding was controlled immediately, a thrombocytopenia of 43,296 per cu. mm. was present. Two days later the count was 34,204 per cu. mm. Determinations after the nineteenth day of illness were normal.

DIFFERENTIAL DIAGNOSIS

Because of its unpredictable symptomatology and clinical picture, infectious mononucleosis may simulate bacterial, virus, rickettsial, neoplastic, or other disorders affecting the respiratory, gastro-intestinal, nervous, hematopoietic, and lymphatic systems. It is well to keep infectious mononucleosis in mind when confronted with fever and lymphocytosis or atypical conditions resembling diphtheria, leukemia, meningitis, agranulocytic angina, appendicitis, or syphilis. Conversely, problems in differential diagnosis may be portrayed in an evaluation of cases suspected but not confirmed to have glandular fever. Thirty patients were so encountered during the two-month interval ending 23 April 1943.

Persistent or recurrent sore throat, exacerbation of fever, atypical exanthem or enanthem, jaundice, epistaxis, leukopenia,

or protracted illness—one or more of these in combination with lymphocytosis or lymphadenopathy called attention to the possibility of underlying infectious mononucleosis. Palpable spleen was encountered in 5 cases of pharyngitis, in 4 of which there were lymphadenopathy and lymphocytosis.

The blood smear report of atypical lymphocytes, type 1, in large numbers and compatible with infectious mononucleosis was encountered in the following conditions: primary atypical (virus) pneumonia; pharyngitis; measles and cholangitis; German measles and tonsillitis and in pharyngitis, laryngitis, and bronchitis. Many of the reportedly negative blood smears revealed the same type 1 atypical lymphocyte, but in too small

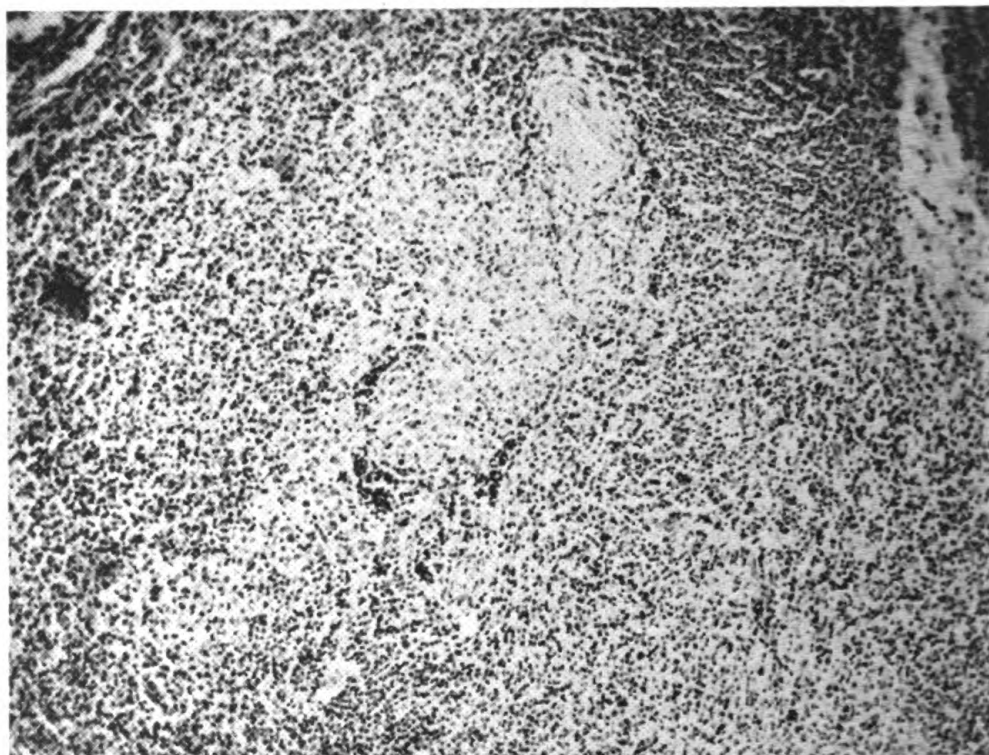


FIGURE 2. Spleen. Low-power view showing hyperplasia of follicular center and of lymphocytic elements of the red pulp.*

numbers to be diagnostic. This, therefore, adds credence to the author's contention that a positive Paul-Bunnell test is requisite to the unequivocal diagnosis of infectious mononucleosis. All sheep cell agglutinations were negative in each case and were performed from one to five times per patient or a total of 60 tests in all.

COMPLICATIONS

The period of hospitalization per patient varied from 4 to 104 days, with a mean of 26 days. Six patients were granted

*Figures 2 and 3 bear no direct relation as far as known to the cases reported by the author. They were selected as illustrations from the files of the Museum and Medical Arts Service, reference number B-135.

leaves of absence up to 30 days for recuperative purposes; but the recent initiation of a convalescent program in the hospital has largely supplanted "sick leaves." Debility, easy fatigue, and asthenia were found to be frequent concurrent and residual manifestations in the 29 cases. In a few instances this symptomatology was of greater concern to the patient and took longer to subside than the disease itself.

The complications were as follows: two cases developed catarrhal sinusitis; two had catarrhal otitis media, one of whom required operation for acute, bilateral, purulent, maxillary sinusitis; two were complicated by residual, localized lymphadenitis, submaxillary and inguinal, respectively; one patient of the previous group and one other developed primary atypical pneumonia a few days after discharge from the hospital; and one subject was given a certificate of disability for discharge from the Army because of pre-existent psychoneurosis and anxiety state.

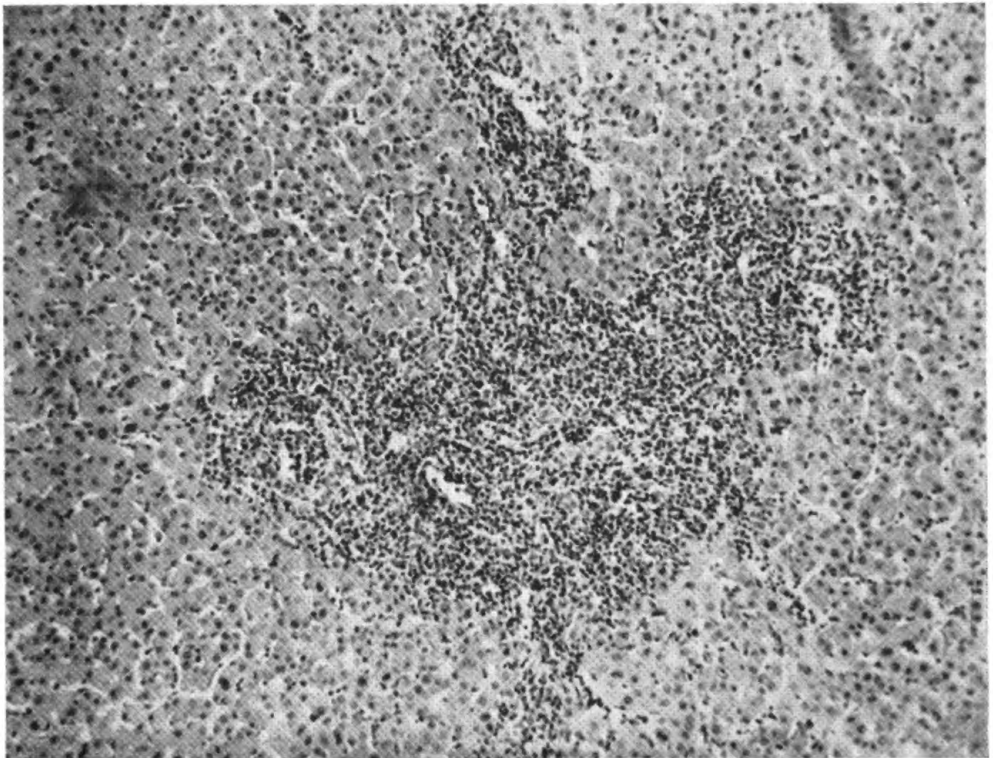


FIGURE 3. Liver. Low-power view demonstrating exaggeration of normal lymphocyte collar in pericardial spaces.

TREATMENT

Therapy may be divided into specific, general, and convalescent. As revealed in the literature specific therapeutic devices and results have been variable. Berkeley²⁴ reports a

24. Berkeley, H. K.: Infectious Mononucleosis; Its Treatment with Scarlet Fever Convalescent Serum, *J. Pediat.*, S. Louis, 20:26, 1942.

satisfactory and early response to intravenous, scarlet fever convalescent serum in 4 subjects. In a preliminary study of 2 cases Saltzman²⁵ is impressed by the symptomatic and objective relief achieved by multiple injections of bismuth. The combined use of sulfanilamide and convalescent serum in three of Thomsen's patients gave more gratifying results than did sulfanilamide alone in 31 treated of 81 cases.²⁶ Hoffman, Lees, and Comroe²⁷ state that sulfathiazole was responsible for marked clinical improvement in 12 treated as compared to 22 untreated patients. Kilham and Steigman⁹ noted no response to sulfadiazine in 5 cases.

In the present series, 12 of the 21 serologically positive cases were given sulfadiazine by mouth. Each patient received an initial dose of 4.0 grams, followed by 1.0 gram every four to six hours. All cases suffered variable degrees of acute tonsillitis or pharyngitis. The mean for the day of illness on which chemotherapy was instituted was 8, and for total dosage of sulfadiazine, 25 grams. In comparison to the 9 untreated cases, 7 of the 12 sulfadiazine treated patients enjoyed more rapid remission of symptoms and objective improvement, usually within forty-eight to seventy-two hours. Questionable response was noted in 3 and no response in 2 patients. Further analysis of cases reveals that sulfadiazine effectiveness roughly parallels the degree of severity of secondary throat infections. Chemotherapy had no appreciable effect on the primary cause of the disease. Lymphadenopathy and splenomegaly and hematological and serological studies showed no deviations from the usual as compared to the untreated group. The author believes, however, that chemotherapy should be continued for one to two weeks beyond the acute stage of illness in anticipation of preventing recurrent respiratory infections and other complications.

General therapy was symptomatic and palliative and did not differ from the usual measures employed for fever, chills, headache, and sore throat. Three days after cessation of symptoms the patients were started on a program of daily increase in activity and sun exposure. Although actual contagious isolation was not practiced, segregation was carried out in those with secondary respiratory infections. Isolation precautions were practiced where exanthemata developed. The same regimen should be incorporated in those patients harboring the hemolytic *Streptococcus*.

CASE REPORTS

CASE 1. A male, 21, was admitted to the hospital on 9 March 1943 with a history of chills and fever every afternoon or evening for ten days but no sore throat, cough, or swollen lymph nodes. He had received 13 grams of

25. Saltzman, M.: The Therapeutic Effect of Bismuth in Infectious Mononucleosis. A Preliminary Statement with Report of Two Cases, *Laryngoscope*, 52:697, 1942.

26. Thomsen, S. Effect of Sulfanilamide in Infectious Mononucleosis, *Ugeskr. laeger*, 102:779, 1940.

27. Hoffman, H. T., Lees, H. D., and Comroe, B. I.: Use of Sulfathiazole in Infectious Mononucleosis, *Am. J. M. Sc.*, 203:731, 1942.

sulfadiazine during the two days prior to admission. Past history was irrelevant. Physical examination revealed an acutely ill young man with hot, dry skin, moderate photophobia, hyperplasia of pharyngeal lymphoid tissues, and three-plus non-tender enlargement of all palpable lymph nodes. Admission diagnosis was acute infectious mononucleosis. Although the first white count revealed a lymphocytosis (65 percent), two days later atypical lymphocytes were noted in sufficient numbers to be diagnostic (20-30 percent). Paul-Bunnell test confirmed the diagnosis.

Although this case represented the febrile type of glandular fever on hospitalization, there developed an intercurrent, moderately severe, acute follicular tonsillitis which subsided slowly during the next twelve days, during which chills occurred regularly every other day, with sustained fever. Bilateral catarrhal otitis media developed in the third week of illness, but subsided promptly under conservative therapy. At this point he suddenly experienced severe sore throat with recurrent chills and prostration. A fine, punctate, erythematous rash developed over the anterior aspect of the trunk, pronounced in the groins and axillae. A diagnosis of scarlet fever was entertained. Under chemotherapy improvement occurred in forty-eight hours and the rash disappeared in three days from onset.

Except for a mild epistaxis and continued debility, the patient encountered no further difficulties until ten days later, when he again developed a catarrhal pharyngitis and recurrent exanthem, identical with the first in type, location, and duration. Again there was satisfactory subjective and objective response to a three-day course of sulfadiazine. At this time the patient showed his first polymorphonuclear response. Desquamation of the skin did not occur.

TABLE III
Laboratory data (Case 2)

Date	Total Wbc.	Percent lymphocytes				Percent neutrophils			Platelets (1000)	Paul-Bunnell test	Kahn	Wasserman
		Total	Large	Small	Young	Segmented	Stabs	Myelocytes				
7 Dec. 1942	14,350	26				74						
8	37,350	34				26	28	12	90		Pos.	
9	22,725	30				51	15	4				
10	20,650	42	9	30	3	50	7		162			
11	15,000	63	33	26	6	40	4					
12	15,700	76	18	55	3	22	2				?	Neg.
14	15,250	63	3	60		35	1		335.6			
17	15,750	76				17	3			1:640	Neg.	
19	11,000	75				16	5					
24	8,900	54				39	1			1:640		
26	7,200	62				30			298.8			
30									215.3	1:40	Neg.	Neg.
2 Feb. 1943	7,900	55				39				Neg.		

In the seventh week of illness the patient developed a bilateral, suppurative, maxillary sinusitis. This resisted daily antral lavage but responded to bilateral sinusotomy. After a stormy course for eleven weeks, convalescence proceeded satisfactorily.

Frequent blood cultures and smears for malaria were negative, taken periodically during the first weeks of hospitalization. Throat culture at onset of first rash revealed only *Staphylococcus albus* and *catarrhalis*.

X-rays of lungs on admission and eight weeks later were normal. Anemia did not develop. Blood sulfadiazine levels (free) varied from 4.0 to 9.0 mg. percent. Chemotherapy apparently did not depress nor interfere with the agglutinin response. The spleen became palpable in the third week of illness, but along with lymph nodes subsided by the end of the fifth week.

The exanthemata noted, it is believed, were manifestations of infectious mononucleosis. The patient was discharged on his 104th hospital day and given a 30-day sick leave.

CASE 2. A male, 24, was admitted 7 December 1942 with the diagnosis of pneumonia. For three weeks he had noted malaise, coryza, and dry cough; and for three days, sore throat, nausea, vomiting, fever, chilliness, productive cough, and weakness. Past history was negative.

Physical examination revealed an acutely ill male, somewhat confused mentally but rational. A marked, discrete, petechial, and purpuric exanthem was present over the entire body, more prominent on trunk and upper arms. Individual lesions varied in size from 1.0 to 5.0 mm. in diameter, a few of the larger ones showing a white center. Similar lesions were present on the conjunctivae and oral mucous membranes. A few shotty lymph nodes were present in the neck, axillae, and left epitrochlear regions. The spleen could not be felt. Examination of the lungs was negative. The reflexes were normal. Examination of the heart revealed sounds of poor quality, suggestive gallop rhythm, and a pulse rate of 130 per minute. Temperature was 102° F. and blood pressure, 80/60.

The laboratory data are given in table III. The leukocytosis, which at first was polymorphonuclear, gradually changed to a relative and absolute lymphocytosis as clinical improvement progressed. Sulfadiazine was given for the first eight days with improvement. Temperature mounted to 106° F. three hours after admission, subsided gradually during the next eight hours, and did not rise above 100.8° thereafter. X-rays of lungs on admission and one week later were negative. Admission blood culture revealed no growth. Bleeding and clotting times and icteric index were normal. Initial blood smears were inconclusive and the true diagnosis was not forthcoming until the first Paul-Bunnell test was done on the tenth hospital day. Hemoglobin and erythrocyte determinations remained normal. The spleen was palpable from 8 December to 22 December, 1 to 2.5 cm. below the left costal margin. Liver was 1.5 cm. below right costal margin on 10 December, and remained so until 23 December. Generalized lymphadenopathy progressed from one plus on 7 December to three plus on 14 December with but slight regression evident at discharge. Purpuric manifestations began to fade on 9 December and had subsided by 11 December. The patient was discharged 8 January 1943. At follow-up examination on 2 February 1943, his condition was satisfactory. A one-plus generalized lymphadenopathy remained. The blood findings on his discharge are given in table III.

SUMMARY

Of 29 cases of infectious mononucleosis presented, only 3 were diagnosed correctly on admission to hospital.

Criteria are set forth for classification of patients into six primary clinical types. In this group there were 18 respiratory;

3 febrile; 3 lymphadenopathy; 1 exanthemata; 2 central nervous system; and 2 gastro-intestinal.

Infectious mononucleosis occurs at any time of year with insidious or sudden and mild or severe onset. The symptomatology is extremely variable. The diagnosis may be difficult in the first few days of illness. Lymphadenopathy, splenomegaly, lymphocytosis, atypical lymphocytes in large numbers, secondary throat infection, fever, and asthenia are common features but are not essential nor diagnostic criteria.

Unequivocal diagnosis depends on the demonstration of sheep cell agglutinins (Paul-Bunnell test) in the patient's blood serum in dilution of 1:64 or more. Absorption tests are necessary in the presence of serum sickness or recent serum administration. Paul-Bunnell agglutinations performed at two- to three-day intervals during the second and third weeks should disclose its positive phase in most instances. The disease simulates many clinical entities. Serial hematological and serological studies for possible infectious mononucleosis should be performed where its possibility exists and the diagnosis is uncertain.

Twelve of 21 serologically positive patients received sulfadiazine in the acute phase of illness. Beneficial results were noted in 58.3 percent. Complications might be prevented and the soldier returned to full duty status more quickly if chemotherapy is continued for one to two weeks beyond the acute stage of illness. Complete remission of lymphadenopathy, splenomegaly, and lymphocytosis would not appear to be a necessary requirement to return to active military duty.



S/Sgt. John W. Nalson and Pvt. Herman Jamnicke both of Tucson, Arizona, testing pack mule litter in New Guinea.

Field Water Supplies in Tunisia

Bacteriologic Observations

CAPTAIN ALVIN F. SELLERS

Veterinary Corps, Army of the United States
and

MAJOR GUY H. GOWEN

Medical Corps, Army of the United States

The practical importance of strict vigilance over water supplies used by troops in the field is well recognized. Dunham states that since sources of infection for intestinal diseases are constantly present in military organizations and in civilian populations with which the troops are in contact, any relaxation in measures for the control of intestinal infections will almost inevitably be followed by the occurrence among troops of some one of these diseases in epidemic form.¹ Our laboratory played an integral part in the sanitary water control program in this area and coincidentally acquired considerable information which was thought to be of sufficient interest and importance to warrant publication. Bacteriologic examination of water samples was done in accordance with Standard Methods for the Examination of Water and Sewage² and Methods for Laboratory Technicians, United States Army.³

One of our mobile units moved into the Tunisian area on 5 May 1943. This same unit changed location on 16 May 1943 and moved into a new locality which a few days previously had been the scene of hostilities. This was coincident with the outbreak of bacillary dysentery. Anticipating demands for laboratory work far in excess of what could be handled by a mobile unit, the base section was moved into the same location on 22 May 1943.

We were immediately requested to investigate this intestinal outbreak and to make recommendations for control. At this time the troops were widely distributed in bivouac areas. During our study of the epidemic we accumulated the

1. Dunham, G. C.: *Military Preventive Medicine*, 3d ed., p. 153. Harrisburg, Pa.: Military Service Publishing Company, 1938.

2. *Standard Methods for the Examination of Water and Sewage*, American Public Health Association, 8th ed., 1936, p. 196.

3. War Department Technical Manual (TM 8-227), *Methods for Laboratory Technicians*, 1941, p. 270.

facts that water points were either not checked bacteriologically or were checked irregularly and infrequently. We also determined that, whereas the water might be bacteriologically potable at the water point, after hauling and handling for distribution to the troops, this same water would show evidence of fecal contamination.

On the basis of these findings the following recommendations were made:

1. Samples from water points should be submitted for bacteriologic examination twice weekly.

2. If at any time a sample proved to be bacteriologically nonpotable, samples should be submitted more frequently until it had been proved that corrective procedures were working efficiently.

3. Once a satisfactory source of water is assured, the responsibility should then rest with the individual unit to see that such water reaches its personnel in a potable condition. This means absolute cleanliness of water trailers, water cans, storage tanks, Lyster bags, etc. Many water samples have been submitted from such equipment for the purpose of determining the presence or absence of contamination. Such equipment should receive continuous attention and not wait for evidence of fecal contamination before being cleaned.

As a result of our findings and recommendations the sectional surgeon issued a directive to field units under his jurisdiction to the effect that the responsibility for ensuring potable water rested with the unit commander and that all water samples from that area should be submitted to our laboratory for bacteriologic examination.

Reports of such water examinations were made in triplicate. One copy was given to the unit submitting the sample, one copy was forwarded to the office of the surgeon, and one copy was retained by us. In this manner those concerned were immediately notified of existing nonpotability and could institute corrective procedures, and the surgeon was kept informed at all times of the status of the water supply and could assign the sanitary officer to any needed investigation.

We were at first called upon to run many bacteriologic examinations of raw water. After running 68 such specimens, we had direct evidence that for all practical purposes no raw water in the area sampled could be considered as being bacteriologically potable and, therefore, should not be used for drinking purposes until after chlorination, or chlorination and filtration as the situation might indicate. The results of these findings are summarized in tables I and II. On the basis of this experience we discouraged the submission of raw water

samples, emphasized the potential hazard of any raw water, and pointed out that effort should rather be concentrated on determining if the treated water was continually maintained in a bacteriologically potable state.

It is felt that as a result of this program all units in this area have become water conscious. When troops move to new locations, or when new units move into this area, we have noted that they now check with us as to the status of the drinking water which they contemplate using. Water points from which we obtain samples are now producing water that is uniformly satisfactory from a bacteriologic standpoint. This was not true three months ago.

TABLE I

Tabulation of raw water samples according to potability and source

Source	No. of samples	Potable		Potability questionable		Not potable	
		No.	Percent	No.	Percent	No.	Percent
Springs	13	4	30.8	4	30.8	5	38.4
Reservoir and distribution outlets (civil)*	35	5	14.3	9	25.7	21	60.0
Wells	12	1	8.3	—	—	11	91.7
Creeks	5	—	—	—	—	5	100.0
Lake	1	1	100.0	—	—	—	—
Unknown	2	—	—	—	—	2	100.0
Total	68	11	16.2	13	19.1	44	64.7

*Twelve reservoir and distribution systems were examined.

In order to show that there has been an improvement in the bacteriologic quality of treated water we have arbitrarily selected for purposes of comparison the periods 5 May to 26 July, and 27 July to 19 August. We felt that the first period would represent the time during which the water control program was being established, and the second period the time when it was well established. The engineer-operated water points were the chosen means of comparison since these are the fundamental sources from which water is drawn for the troops, and since it was from these that most of our chlorinated samples originated. From 5 May to 26 July there were 144 samples submitted, and of these 10, or 6.9 percent, proved to

TABLE II
Detailed summary of questionable and not potable raw water samples listed in table I

Source	Potability questionable			Not potable			
	Number	High colony count	C—A* present in 1-2 10-cc. lactose tubes	Number	C—A* in 1-2 10-cc. lact. tubes, col. ct. high	High colony count plus gas in one or more lact. tubes	C—A* and low or high colony count
Springs	4	—	4	5	—	—	5
Reservoir and distribution system outlets (civil)	9	3	6	21	1	—	20
Wells	—	—	—	11	—	—	11
Creeks	—	—	—	5	—	—	5
Unknown	—	—	—	2	1	—	1
Total	13	3	10	44	2	—	42

*Coll-aerogenes group organisms.

be nonpotable. From 27 July to 19 August there were 72 samples submitted, and of these 1, or 1.4 percent, proved to be nonpotable. This shows an improvement of practically 80 percent in the efficiency with which such water was treated.

The accompanying tables are based on the period 5 May to 26 July when our greatest activity was in progress. No raw water samples have been run since 26 July; therefore, tables I and II may be considered as the complete picture in regard to raw water. No additional tables were made for comparing chlorinated samples of the period 27 July to 19 August with tables III and IV, since practically all the samples for the second period originated from water points, and these differences have been mentioned in the previous paragraph. In tables I and II the total samples indicate the actual number of

TABLE III
Tabulation of chlorinated water samples according to potability and source*

Source	Number of samples	Potable		Potability questionable		Not potable	
		Number	Percent	Number	Percent	Number	Percent
Water points	144	128	89.0	6	4.1	10	6.9
Water trailers	25	22	88.0	1	4.0	2	8.0
Tanks (canvas and metal)	7	5	71.4	—	—	2	28.6
Lyster bags	30	23	76.7	3	10.0	4	13.3
Reservoir and distributing system outlets (Army)	53	48	90.6	4	7.5	1	1.9
Reservoir and distributing system outlets (civil)	30	21	70.0	5	16.7	4	13.3
Wells	8	6	75.0	1	12.5	1	12.5
Water cans, coolers, and canteens ...	4	2	50.0	1	25.0	1	25.0
Unknown	3	2	66.7	1	33.3	—	—
Total	304	257	84.6	22	7.2	25	8.2

*Stated chlorine residuals, water points, 0.2 to 2.0 p.p.m. Degree of chlorination of other sources is not specifically known.

TABLE IV
Detailed summary of questionable and not potable chlorinated water samples listed in table III

Source	Potability questionable			Not potable			
	Number	High colony count	C—A* present in 1-2 10-cc. lactose tubes	Number	C—A* in 1-2 10-cc. lact. tubes, col. ct. high	High colony count plus gas in one or more lact. tubes	C—A* and low or high colony count
Water points	6	3	3	10	1	1	8
Water trailers	1	—	1	2	—	—	2
Tanks (canvas and metal) ..	—	—	—	2	—	—	2
Lyster bags	3	2	1	4	1	1	2
Reservoir and distributing system outlets (Army) ...	4	4	—	1	—	—	1
Reservoir and distributing system outlets (civil)	5	2	3	4	—	1	3
Wells	1	1	—	1	—	—	1
Water cans, coolers, and canteens	1	1	—	1	—	1	—
Unknown	1	—	1	—	—	—	—
Total	22	13	9	25	2	4	19

*Coli-aerogenes group organisms.

different sources. In tables III and IV the data summarized includes repeat samples on 41 different water points, 20 water trailers, 5 tanks (canvas and metal), 28 Lyster bags, 10 outlets of three reservoir and distribution systems (Army), 22 outlets of 12 reservoir and distribution system (civil), and three miscellaneous (water cooler, canteen, and water can).

SUMMARY

1. A discussion and tabulation have been presented of our findings in the bacteriologic examination of 444 raw and chlorinated water samples from a wide variety of sources in Tunisia during the period 5 May to 19 August 1943.

2. Our experience would indicate that for all practical purposes raw water in this area must be considered to be bacteriologically nonpotable.

3. The value of a systematic check bacteriologically of chlorinated water supplies under field conditions would seem to be indicated by the fact that this resulted in an 80 percent improvement in the efficiency with which water was treated at Army water points.

4. The important part a mobile medical laboratory may play in a water control program under field conditions is clearly indicated.

Neuropsychiatric Outpatient Department

CAPTAIN NICOLAI GIOSCIA

Medical Corps, Army of the United States
and

CAPTAIN JOSEPH J. MICHAELS

Medical Corps, Army of the United States

In this report a process is described which facilitates the disposition of neuropsychiatric patients and shortens the period of hospitalization. The number of occupied beds in the neuropsychiatric department of the post hospital, Camp Breckinridge, Kentucky, has been kept at a minimum by maintaining an active outpatient clinic in the neuropsychiatric section. This is a training camp for various types of military units. The psychiatric problems which arise in these organizations are referred directly to the neuropsychiatric section by their respective dispensary surgeons for consultation, diagnosis, treatment, and disposition. These referrals are scheduled by

appointment to the neuropsychiatric outpatient clinic and not routinely admitted to the hospital. The entire camp is made aware of this procedure. In making an appointment with the neuropsychiatric clinic, company commanders are requested to forward a short report stating the reason for referral and a brief description of the military adjustment of the soldier. The dispensary surgeon requests a neuropsychiatric consultation.

The patient appears at an appointed time and is seen by the neuropsychiatrist. On this initial visit, a thorough history is taken and a physical and neurologic examination is made. If the patient is seriously ill, he is immediately hospitalized. If the problem does not presuppose marked antisocial behavior and the soldier can go back to his unit without detriment to himself and his associates, he is returned after the first examination. Thus, the soldier who is not too sick in a disruptive way may return and function with his assigned organization, the soldier does not lose contact with his unit, he has been spared being confined in a psychiatric ward, and a hospital bed has not been unnecessarily occupied.

APPOINTMENTS

An appointment is then made for the soldier to return to the clinic in two weeks during which time the necessary data are gathered. This consists of a personal interview with his commanding officer by the psychiatrist or the psychiatric social worker and a social history from his home community. When indicated, letters are written to former employers, school, social agencies, and physicians who might have knowledge of his past adjustment and medical condition. On the subsequent visit to the clinic, the data having been assembled, it is possible to arrive at a diagnosis, the line of duty status, and disposition from a medical and military standpoint. If the problem is found to be serious, requiring separation from the service within a short period of hospitalization, a certificate of disability for discharge is instituted. If the problem is a mild maladjustment or mild psychoneurosis which can be treated and corrected by psychotherapy, then contact and treatment are continued.

The interview with the patient's commanding officer is a very important factor in treatment. As the line officer comes to experience and to realize the psychiatrist's interest in his soldier and organization, he usually becomes an active positive participant in the situation. The psychiatrist who

has thus established a rapport with the officer is in a position to obtain an objective evaluation of the setup and hear a firsthand report about the patient's difficulty. When the psychiatrist regards the patient's condition as being produced or aggravated by situational factors and he believes a different assignment would help solve the problem, this is accomplished through this relationship with the line officer, since by this time, he is ready to do what he can to ameliorate the situation. In addition to the specific influence that is brought to bear on the line officer, he becomes more appreciative of and sensitive to the psychiatrist's point of view. As a result of this helpful experience, the psychiatric point of view may be spread even further to the officers in the field. With the new policies outlined in Circular No. 293, War Department, 11 November 1943, that classification, assignment, reassignment, and training as command functions are to be exercised energetically, there is especially new significance to the further enhancement of accord with the line officer.

The advantages in the above method can be even more readily understood in the disposition of a soldier with a constitutional psychopathic state. Because this condition is considered a "state" rather than a disease, disposition must be carried out through the provisions of Section VIII, AR 615-360. Following completion of the case study, an abstract recommending Section VIII is immediately forwarded to the soldier's commanding officer. The recommendations of the psychiatrist can thus be expediently carried out without the utilization of a hospital bed.

The clinic has used the same procedure in the disposition of soldiers with epilepsy. In such cases the patient, instead of being admitted to hospital, is recommended for tasks or assignments easily available to medical facilities, so when the patient has a seizure, it can be witnessed by a medical officer. With hospitalization, there is a diminution of stresses and strains and a reduction of symptomatology. In soldiers with epilepsy, such a reduction may be sufficient to increase the threshold to stimuli of a physiological and emotional nature and improve the general condition so that a healthier equilibrium is established. Therefore, the tendency to react with symptoms—in this instance, an epileptic seizure—would be reduced and the possibility of observing phenomena would be defeated. The more the patient can remain in the environment which precipitates the symptoms, the closer one approx-

imates the real state of affairs. In other words, the patient can be observed in an experimental situation which provides a true test of his reaction, thus expediting diagnosis, and again conserving hospital beds.

Various types of conditions which are considered as "states" can easily be handled through clinic procedure. If a soldier attempts to malingering and he realizes that the examiner is taking his statements seriously and will check the veracity of them, he may decide to give up the game.

ADVANTAGES

From the viewpoint of the Medical Department, the procedure described has many advantages. What about the advantages to the line officer? When it comes to the point of referring a soldier to the hospital, the line officer has probably reached the conclusion that the soldier is of no further use to his unit and the sooner he is eliminated from the outfit, the better for all concerned. The line officer feels that he would like to have the best possible organization, with men who are sound physically and mentally, and resents "nursing" along soldiers who are returned to him for further care until the hospital is ready for definite action. Although this may be the case, the carrying of the soldier on his roster under observation for so short a period, which is insufficient to obtain a replacement, would not seem to be too much of a handicap to the organization. In fact, the soldier who is under this type of observation can continue to do simple, useful tasks, thus conserving manpower. With the explanation to the line officer that any soldier with a serious neuropsychiatric ailment or a psychopath who is a real menace can be immediately hospitalized, he can feel secure.

CONCLUSIONS

1. The number of beds occupied by neuropsychiatric patients has been materially reduced.
2. During the period of study in which the patient remains with his organization, manpower is conserved, special reactions such as epileptic seizures can be observed, and the stigma of psychiatric hospitalization is avoided.
3. Rapport with the line officer and his organization has had the effect of wider appreciation of psychiatry in the field. Changes in assignment are facilitated.

Injury to Cerebral Cortex Following Anoxemia and Exsanguination

Report of Case

MAJOR REYNOLD E. CHURCH

Medical Corps, Army of the United States
and

MAJOR LEWIS H. LOESER

Medical Corps, Army of the United States

Modern aerial warfare has resulted in the appearance of clinical syndromes hitherto seen only in the experimental laboratory. As would be expected, cases are seen presenting evidence of exsanguination following multiple puncture wounds and hemorrhage; anoxemia following injury to oxygen apparatus; exposure to cold, following injury to heating apparatus; and shock, resulting from the combined effect of the previous three factors. To evaluate the role of each of these factors is difficult, for under combat conditions, the duration and degree of anoxemia and estimation of blood loss are determined in retrospect. Exsanguination and anoxemia have in common the effect of depriving the body of vital supporting substances. Of these substances, oxygen deprivation is observed earliest, and it is first manifested in the cerebrum, particularly in the cortex.

The following report concerns a case of cortical dysfunction in which the foregoing factors have operated. The clinical manifestations are consistent with previous laboratory data. The diffuse necrobiotic changes in the cortex were reflected in a restless hyperkinetic, maniacal type of delirium and were followed by aphasia, alexia, agraphia, and other manifestations of cortical defect.

CASE REPORT

The patient was a ball turret gunner in a heavy bomber. A bombing run was made over the target at a high elevation and descent began immediately after leaving the target. About five minutes later at an estimated altitude of 22,000 feet, a 20 mm. shell exploded within the ball turret, and the patient

Accepted for publication on 15 November 1943.

received multiple penetrating wounds of arms, legs, feet, buttocks, penis, scrotum, and upper left chest, from which he bled profusely. He was removed from the ball turret by members of the crew at 16,000 feet about fourteen minutes after being wounded. The degree of anoxia suffered during this period is in doubt. The patient was semiconscious during the remainder of the flight and became unconscious a few minutes after landing. He was removed from the plane two hours, twenty-seven minutes, after being wounded and was immediately taken to the crashroom where he received 1,000 cc. of plasma and 500 cc. of O type blood. The wounds were bandaged, the hemorrhage controlled, and the patient was removed to a hospital seven hours after injury. He was in shock and irrational. Pulse was 140; blood pressure, 78/56; hemoglobin, 40 percent; red blood count, 2,500,000. Several times he yelled, "I can't see." Plasma, 1,000 cc., and oxygen by mask were administered, and dressings and splints applied. One hour later 500 cc. of whole blood were given, followed by 500 cc. of plasma. Morphine sulfate, gr. $\frac{1}{4}$, failed to control the restless delirium; 5 percent glucose, 1,500 cc. in normal saline, was given the following day. Sulfathiazole therapy was started. The maniacal delirium continued, despite the use of barbiturates. On the second day, a Levin tube was inserted through the nose and fluid, food, and medication were thus administered. On the third day the intensity of the delirium decreased and vision seemed improved. The patient had rational intervals on the fourth day and began to take fluid by mouth. His scrotum became infected and gangrene of the left testicle developed. Spinal anesthesia was chosen as the least likely to produce further complications and orchidectomy was performed. General improvement continued slowly. Speech and comprehension of speech returned in a progressive manner; however, twenty-eight days later defects in cerebral function were still present.

NEUROPSYCHIATRIC STATUS

On admission the patient was maniacal and in hyperactive delirium. Speech was repetitive and showed marked perseveration. He was completely out of contact with the environment and failed to respond to questions. Loud obscene shouting alternated with short comatose spells. The neurological status revealed no abnormalities other than persistent, rhythmic, repetitive, purposeful movements of the hands and

arms. The fundi were normal, pupils equal, and reflexes depressed but equal. No pyramidal tract signs were found. Sensory and other tests could not be carried out in view of his condition. There was apparently a delirium state with cerebral injury secondary to prolonged anoxemia, exposure to cold, shock, and loss of blood.

About the tenth day, the patient's left pupil was noted to be larger than the right, and a paralysis of the ulnar and the peroneal nerves on the left, with complete loss of flexion of the hand and of dorsiflexion of the foot were present. Several observers verified the impression that muscle function had previously been intact in these areas and that the muscle paralysis developed between the seventh and tenth days. As the delirium ended, he was left with a severe language defect. He expressed himself with difficulty, at times speaking a confused jargon. He had the most difficulty with nouns. Comprehension, also, was faulty. He often carried out commands incorrectly but usually approximated a correct interpretation.

On the twenty-eighth day, a moderate degree of motor aphasia still persisted. Proper names and names of unfamiliar objects were most involved, and verbs and adjectives to a lesser degree. The sensory and motor aphasias present were about equal. Evidence of retraining could be seen, but efforts to correct mistakes in speech were frequently unsuccessful. Alexia was marked. The patient could read aloud in a fairly appropriate manner, but comprehension of reading material was restricted and absurd mistakes were made in interpreting simple sentences. Agraphia was present to a moderate degree. He could write simple words but in trying to write complete sentences, words and syllables were omitted.

Psychometric testing using Shipley-Hartford and Binet-Simon material revealed a mental age at about 15½ years. Evidence of organic deterioration was not elicited by the Shipley-Hartford tests. While the language defect interfered with various tests, careful testing revealed conceptual and abstract processes adequate for the mental age level.

Neurological examination on the twenty-eighth day revealed the left pupil larger than the right, ulnar nerve palsy (left) about 80 percent complete, both sensory and motor, and peroneal nerve palsy (left) about 90 percent complete, both sensory and motor. Improvement in all functions has continued to date.

COMMENT

Effect of partial exsanguination. Murphy¹ recently reported a case with severe neuropsychiatric disability following partial exsanguination. Intellectual deterioration, confusion, disorientation, and loss of memory were correlated with diffuse necrobiotic changes in the cortex. Comparison was made with the laboratory experiments of Gildea and Cobb² in which the relative susceptibility of the cortex to deprivation of blood supply was noted. Kubat and Dennis³ reported similar changes in dogs, and in chronic cases they were able to produce decerebrate animals.

Analogous cases in humans have been recorded. Factors producing ischemia, usually loss of blood and sudden fall of blood pressure, have resulted in definite and irreparable injury to the central nervous system. Wolf and Siris⁴ under the title, "Acute Non-traumatic Encephalomalacia," described severe cerebral injuries in four cases operated on for neurosurgical conditions in the upright position. Following a sudden drop in blood pressure during the operation, extensive bilateral hemorrhagic necrosis of the cortex and superficial subcortex was found at necropsy. Schnedorf, Lorhan, and Orr⁵ describe a case which occurred under spinal anesthesia. Coma, convulsive seizures, and evidence of pyramidal tract involvement and irrational behavior occurred postoperatively. The patient died on the twenty-first day. The cortical grey matter was found altered with necrobiotic changes.

The correlation between the case reported at this time and the references in the preceding paragraph are obvious. Exsanguination, shock, upright position, and fall of blood pressure were present. The sequelae, convalescence, and the resulting disability all point to the cerebral cortex as the area most involved, and they are consistent with the laboratory findings on experimental animals.

Anoxemia. Interest in anoxemia and its effect on nerve tissue has been stimulated by high altitude flying. Thorner and Lewy⁶ discuss the effect of anoxemia on excised nerve tissue, pointing out that increased irritability follows anox-

1. Murphy, J. P.: Arch. Neurol. Psychiat., Chic., 49:594-598, April 1943.

2. Gildea, E. F., and Cobb, S.: Arch. Neur. Psychiat., Chic., 23:876, May 1930.

3. Kubat, H., and Dennis, C.: Proc. Soc. Exp. Biol., N. Y., 38:864, 1938.

4. Wolf, A., and Siris, J.: Bull. Neur. Inst. N. Y., 6:42, 1937.

5. Schnedorf, J. G., Lorhan, P. H., and Orr, T. G.: Arch. Surg., 43:169, Aug. 1941.

6. Thorner, M. W., and Lewy, F. H.: J. A. M. A., 115:1595-1600, 9 Nov. 1940.

emia and later irreversible changes occur with irreparable injury. Reference is made to the experimental work of Lehmonn⁷ on excised nerve tissue and to the work of Gildea and Cobb.² It is generally agreed that the cerebral cortex is the most vulnerable tissue in the body to anoxemia, reacting with focal areas of necrosis and injury to ganglion cells. Cortical tissue does not recover if anoxic for eight minutes. Other parts of the central nervous system and spinal cord can be anoxic for thirty minutes and recover. Smooth muscle tissue is least sensitive to anoxia and can recover after hours. Tissues high in the evolutionary scale are most sensitive to anoxia.^{8 9 10}

Considerable is known regarding the limits of tolerance of anoxia of the human brain. Healthy humans can tolerate a reduction of oxygen pressure of one-third, corresponding to a height of about 12,000 feet. Behnke and Willmon¹¹ advise the use of supplementary oxygen at all times above 15,000 feet, at 12,000 to 15,000 feet if exposed for more than two hours, and at 10,000 feet if exposed longer than six hours. Above 12,000 feet symptoms of anoxemia are noted at varying periods in most cases. Usually a period of initial stimulation and euphoria occurs followed by decreased attention, failure of co-ordination, vertigo, impaired judgment and memory, failing vision, and ultimately loss of consciousness. The degree of anoxia and the time factor are important in determining the sequence and severity of symptoms.^{8 11 12 13 14} At 10,000 to 12,000 feet, exposure of two to six hours may produce headache and fatigue. At 15,000 to 18,000 feet, two hours' exposure will frequently result in severe headache, nausea and vomiting, vertigo, and weakness; fifteen to twenty minutes at higher altitudes may produce symptoms which may persist for one to three days.

Anoxemia can be prevented by inhalation of oxygen up to 33,000 feet, above which the low oxygen pressure results in partial anoxia despite the use of pure oxygen; at 43,000

7. Lehmonn, J. E.: *Am. J. Physiol.*, 119:111, May 1937.

8. McFarland, A. R.: *Am. J. Psychiat.*, 97:858-877, January 1941.

9. Heymans, C., and Bouckaert, J. J.: *Compt. rend. soc. de biol.*, 119:324, 1935.

10. Cannon, W. B.: *Am. J. M. Sc.*, 189:1-14, 1935.

11. Behnke, A. R., and Willmon, T. L.: *U. S. Nav. M. Bull.*, 39:163-178, April 1941.

12. Bauer, L. H.: *Ann. Int. M.*, 18:15-20, January 1943.

13. Thompson, J. W., and Corwin, W.: *Arch. Neur. Psychiat.*, Chic., 40:1233-1240, Dec. 1938.

14. Armstrong, H. G., and Heim, J. W.: *J. Lab. Clin. M.*, 26:263-271, October 1940.

feet, unconsciousness will result. It is, therefore, impossible to fly above this ceiling without the use of pressure suits or pressure cabins, even with the aid of pure oxygen.¹⁴

Considerable difference of opinion exists about the degree of acclimatization which may take place as a result of exposure to high altitudes. Humans living at high altitudes do make certain physiologic adjustments. In the Andes, at the highest locality known to be inhabited by man, miners are able to live comfortably at 17,500 feet and to work in the mines at 18,500 feet. Since efforts to live at 18,500 feet were unsuccessful, it is probable that the highest altitude to which man can adapt is about 17,500 feet.⁸

Under the term, "chronic mountain sickness," Monge¹⁵ described a syndrome in newcomers to high altitudes, characterized by cyanosis, weakness, insomnia, blurred vision, syncope, nausea, aphonia, impaired memory and judgment, confusion, and transient psychotic episodes. The condition disappears promptly on return to lower levels. In view of the transient psychotic episodes seen in this disease, caused by chronic anoxemia, it is interesting to speculate on the possible relationship to schizophrenia⁹ and allied conditions.⁸

Whether adaptation occurs in persons exposed to high altitude intermittently is a moot question. Some, particularly those in the field of aviation, feel that adaptation does occur, but considerable experimental evidence indicates otherwise. Armstrong and Heim¹⁶ exposed animals to one-half atmosphere pressure for four hours daily and found complete failure of adaptation. Definite deterioration, progressive anemia, adrenal hypertrophy with cortical degeneration and hemorrhage into the spinal cord were noted. Behnke and Willmon quote Heller, Mager, and Von Schrötter,¹⁷ who demonstrated failure of adaptation. Their subjects developed irritability, nervousness, anorexia, loss of weight, and ultimately decreased ability to withstand high altitudes after repeated daily exposure to high altitude pressures. This question has an important bearing on "flying fatigue" and other reactions of flyers exposed to intermittent high altitude conditions of modern warfare and requires further study.

15. Monge, J.: *Arch. Int. M.*, 59:32, 1937.

16. Armstrong, H. L., and Heim, J. W.: *J. Aviat. Med.*, 9:84-91, June 1938.

17. Heller, R., Mager, W., and von Schrotter, H.: *Luftdruck-Erkrankungen*, vols. I and II. Vienna: A. Holder, 1900.

Cases of anoxemia presenting clinical syndromes analogous to our case have been reported. Neilson and Friedman,¹⁸ report two cases, one following a period of apnea lasting six minutes during spinal anesthesia, the other a case of hanging, both of whom presented the picture of restless, overactive, maniacal delirium. Steegman¹⁹ reported four cases of prolonged anoxemia, two following nitrous oxide anesthesia, one with avertin and one with cyclopropane. The clinical syndrome in all cases was characterized by coma or stupor interrupted by screaming maniacal delirium, hyperkinetic restless motor symptoms, visual disturbances, and autonomic signs—variability in pulse and blood pressure.

Thompson and Corwin¹³ describe a case with milder anoxemia following exposure in a low pressure chamber. Confusion, disorientation, and other psychic changes developed and persisted for at least seven days. The common syndrome noted throughout the literature is that of severe cerebral injury, predominantly cortical, manifested by restless, hyperkinetic motor phenomenon and maniacal delirium.

There is, of course, a similarity between our case and carbon monoxide poisoning. Our case, in addition to the delirium state, developed peripheral nerve palsies between the seventh and tenth days, a complication frequently reported following carbon monoxide poisoning. The similarity in clinical manifestations may be explained by the common denominator of cerebral anoxia. Carbon monoxide, cyanides, and other similar agents act on the hemoglobin, reducing oxygen-carrying capacity, and thereby produce injury to the tissue most sensitive to anoxia, the central nervous system.

TREATMENT

Treatment of these cases, which must be prompt, is directed at five aspects of the problem: anoxemia, shock, loss of blood, delirium, and supportive care of patient.

Anoxemia. Oxygen should be administered as early as possible, preferably while still in flight, and should be continued until the patient is in the hands of medical authorities. Members of the crew should be instructed to administer oxygen to all personnel wounded at high altitude, as soon as conditions permit. At the same time the head should be lowered with the patient in the horizontal position. Experimental and clin-

18. Neilson, J. M., and Friedman, A. P.: Bull. Los Angeles Neur. Soc., 7:202-203, Dec. 1942.

19. Steegman, A. T.: Arch. Neur. Psychiat., Chic., 41:955-977, May 1939.

ical evidence⁴ indicates that the upright position superimposes an additional hazard and increases cerebral anemia in the presence of exsanguination.

Shock. Treatment of shock is mostly routine. Plasma transfusions are indicated early and frequently. Glucose and saline infusions are necessary to restore body fluid volume. Warmth, hot food, and drink are given. Wounded extremities should be splinted to avoid movement.

Loss of blood. Transfusions of whole blood are necessary to increase oxygen-carrying ability of the blood. Early within the first twenty-four hours, 500 to 1,000 cc. should be given.

Management of delirium. The delirium in these cases is severe and difficult to control. Morphine, which does not control the symptoms and the effect of which on the respiratory centers is enhanced, is not advised. Barbiturates are of moderate value; large doses are needed. Paraldehyde may be most effective. Moderate restraint will be necessary, as these patients thrash about and will fall out of bed unless carefully watched. The delirium must be controlled, at least in part, for the added physical exhaustion may be the deciding factor between death and recovery.

Supportive care of patient. After the first twenty-four hours, in which heroic measures are necessary, general support and nutrition become important. The Levin tube in this connection, which has been of inestimable value, provides a method of giving food, fluids, and medication during the difficult early days of overactivity and delirium. With moderate restraint of the arms, the tube can be left in place for several days, permitting hourly feedings of nutrients and medication. Surgical procedures are contraindicated until the case is well under control. First-aid treatment, which should be simple, should aim to avoid further shock and loss of blood. Sulfa drugs may be given via Levin tube to insure against infection.

SUMMARY

The case described showed injury to the nervous system following exsanguination, anoxemia, and exposure to cold and shock. The characteristic syndrome of cortical cerebral injury, resulting in restless, maniacal delirium, was present. The sequelae were aphasia, alexia, and agraphia. Under conditions of aerial combat, similar cases probably will be seen.

Pack Palsy

MAJOR BARNES WOODHALL

Medical Corps, Army of the United States

Among injuries not directly related to the hazard of warfare is "pack" palsy, caused by carrying a fully loaded knapsack and marked by neural dysfunction of the shoulder girdle musculature. Ilfeld and Holder¹ described a unilateral paralysis of the serratus anterior muscle in a soldier who had carried a heavy knapsack on a long hike. Two other cases of serratus anterior muscle paralysis, one from lifting a heavy weight, the other from direct trauma to the shoulder girdle, were reported by Hauser and Martin.² That the condition is not rare, that it may be bilateral, and that the neural dysfunction may be widespread, are suggested by three cases seen at the Ashford General Hospital in a period of four months. The case in which bilateral pack palsy developed is of special interest.

REPORT OF CASES

CASE 1. First Lieutenant W.H.G. was admitted to the Ashford General Hospital on 12 April 1943, complaining of weakness in both shoulders and inability to abduct both arms above thirty degrees. On 11 December 1942, he carried packs weighing 130 pounds for from four to five hours en route to a port of embarkation. During the evening his shoulder muscles were painful and numbness was present in both arms. The following morning the numbness had disappeared but he could not raise his right arm from his side. Later in the day, he noted that both arms were equally affected. He could raise both arms upward when they were forward of his body but could not abduct the arms in a sagittal plane above 30 degrees. He could not shrug his shoulders. After onset of muscle weakness, no further progress of the disturbance was noted except atrophy of both trapezii. With this, his shoulders slumped forward and he felt a lack of support in both shoulder girdles. When wearing tight clothing about the neck he had tingling sensations, poorly localized in both forearms.

Previous to Army service, he had difficulty in fitting shirts and coats because of his long neck, sloping shoulders, and prominent trapezius musculature. He had frequent pain in both shoulders when carrying a heavy iron bar, without, however, evidence of motor or sensory loss of function. Previous to onset of bilateral palsy, he had not carried weight approximating 130 pounds on either shoulder.

1. Ilfeld, F. W., and Holder, H. G.: Winged Scapula; Case Occurring in Soldier from Knapsack, J. A. M. A., 120:448-449, 10 October 1942.

2. Hauser, C. U., and Martin, W. F.: Two Additional Cases of Traumatic Winged Scapula Occurring in the Armed Forces, J. A. M. A., 121:667-668, 27 February 1943.

He was 6 feet in height, slender, weighing 170 pounds. Both shoulders slumped forward with internal rotation of the upper extremities. The neck was abnormally long and the neck-shoulder angles were flattened bilaterally. There was bilateral loss of function of the middle and lower thirds of the trapezii, and bilateral weakness of the major and minor rhomboideus, serratus anterior and levator of the scapula, and of the upper thirds of both trapezii. The pectoral musculature was heavily developed and contracted. The deltoid musculature was equally well developed. Marked atrophy of both trapezius muscles was present. The internal margins of both scapulae were displaced outward. Muscle function tests disclosed the following results: both shoulders were elevated to the usual height but this position could not be maintained under firm pressure. Both arms could be elevated above the head in the forward plane of the body. In the sagittal plane, the arms could be abducted only to 30 degrees. At this point, the scapulae dislocated forwards. The patient could hold the upper extremities at 90 degrees after they had been placed in this position but could not maintain the posture under firm pressure. With the arms at the side, the scapulae could be approximated; with the arms adducted and internally rotated behind the trunk, the scapulae could not be approximated. Pressure of either arm against firm counter-pressure caused slight winging of the scapular tips. With the hand on the opposite shoulder, pressure on the extended elbow caused flaring of the vertebral borders of the scapulae. Palpation of and passive backward thrust of the shoulders demonstrated shortening spasm of the heavy pectoral musculature. No sensory or reflex changes were elicited.

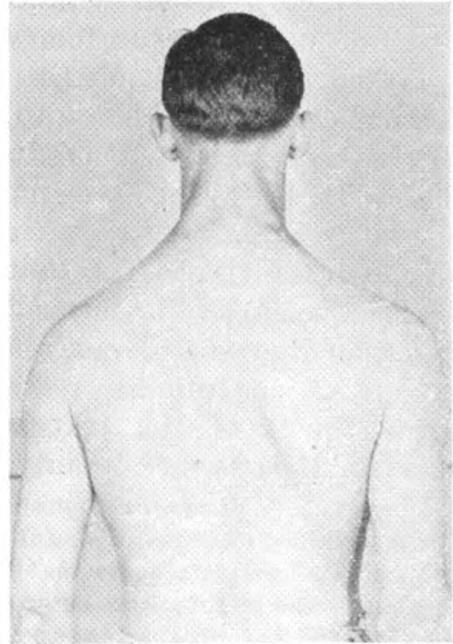


FIGURE 1. Bilateral pack palsy nine months after inception. Note sloping contours of trapezii and slight flaring of vertebral tip of right scapula.

It was apparent that the accessory, the dorsal scapular, and the long thoracic nerves were involved bilaterally and that the resulting deformity and loss of function were due in part to their dysfunction and in part to the pre-existing skeletal abnormality. Roentgen examination of the spine showed seven cervical, twelve thoracic, and five lumbar vertebrae present, low clavicles, a chest wall sloping sharply in the region of the first and second ribs, and unusually long transverse processes of the first dorsal vertebrae. The relatively exposed position of the accessory nerve,

the proximity of the dorsal scapular and long thoracic nerves to the transverse vertebral processes, and the early history of ill-defined transient numbness in the upper extremities suggest peripheral compression of these components of the brachial plexus between the knapsack strap and the abnormally developed cervical-dorsal vertebral column. Compression of the roots of C5 and C6, rather than a more peripherally situated area of compression, offered an equally valid assumption. Muscle stimulation studies were not possible.

Bilateral mechanical support of the affected musculature did not seem feasible in this instance. Treatment with radiant heat and massage was followed by rapid improvement. On 23 September 1943, abduction to 95 degrees was reported (figures 1 and 2), with the left upper extremity improving more rapidly than the right. The failure to secure complete abduction at this time represented continued paresis of the middle and inferior thirds of the trapezius muscles. He returned to duty.

CASE 2. L. S., private, was admitted to the Ashford General Hospital on 15 May 1942, complaining of inability to abduct the right arm above 90 degrees. He had had no symptoms referable to the shoulder girdle musculature prior to Army service. In August 1942, while undergoing training, he developed aching pain in the right shoulder and weakness in the right arm, marked by inability to abduct the right arm from his side with full power. The arm appeared to hang down as if unsupported. He had been carrying a heavy pack and rifle during this time. He could relieve the severity of the pain by shifting the pack from his right shoulder. At times, the right arm became numb but occasionally this could be relieved by removing the pack or rifle from the shoulder. He reported on sick call on several occasions. In October, he noted that the muscles about the shoulder and neck were becoming smaller and that he could not abduct the arm above 90 degrees. In November, his shoulder became swollen after prolonged rifle fire and he was hospitalized. On 4 December the right anterior scalenus muscle was sectioned with operative trauma to the right subclavian artery which was ligated. Since then no improvement in his primary

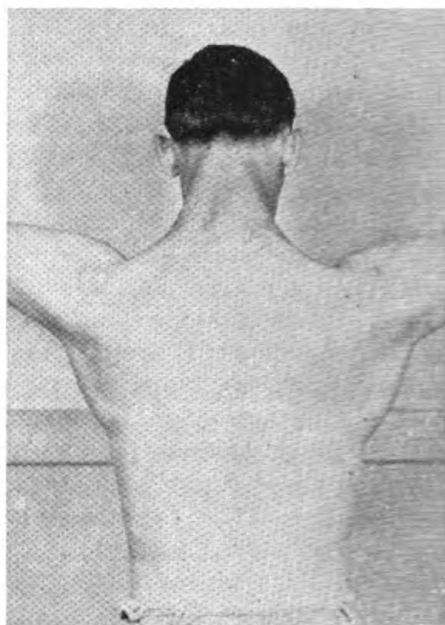


FIGURE 2. Abduction in bilateral pack palsy of nine months' duration. Note asymmetrical atrophy of superior thirds of trapezii and forward and lateral dislocation of both scapulae.

complaint of loss of abduction of the right arm has occurred. Full flexion of the arm was possible; that is, the arm could be fully elevated in the forward plane of the body. He complained of dull aching pain in the posterior aspect of the right shoulder.

The patient was a well-developed man with no manifest physical deformity. Moderate atrophy of the clavicular portion of the trapezius was present. Elevation of the shoulder was possible but could not be maintained under firm pressure. The internal margin of the scapula was displaced outward, broadening the back, and the shoulder was drawn forward and downward. The arm was abducted slowly to 60 degrees when further attempt at abduction caused a forward dislocation of the scapula (figure 3). With the scapula held firmly against the chest wall, slow abduction was possible through 90 degrees, followed by rapid rotation of the scapular tip forward, through action of the serratus anterior, and by completion of abduction. In the forward plane of the body, full abduction, or flexion of the arm, was possible. Counterpressure against the extended arm caused no flaring of the scapular tip. Galvanic stimulus with the de Jong portable electro-stimulator showed accessory nerve conduction on the normal side of 5 Ma., and on the affected side of 15 Ma. Normal, rapid contraction was noted in the muscle fibers of the upper third of the affected trapezius. No reactions were seen in the middle and lower thirds of the muscle. Normal reactions to galvanic stimulus were secured from the deltoid, rhomboidei, levator scapulae, and serratus anterior. Roentgenography showed no abnormal skeletal changes.

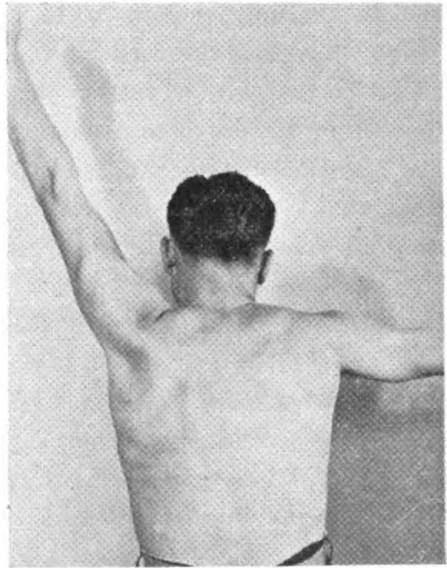


FIGURE 3. Right-sided pack palsy of twelve months' duration. Note failure of abduction beyond 90 degrees with dislocation of the right scapula laterally and anteriorly, the result of paralysis of the middle and lower thirds of the right trapezius muscle.

The extremity was placed in an aeroplane or abduction splint with the humerus in slight external rotation and treated daily with radiant heat and massage. No improvement was manifest twelve months following the initial injury and six months following the onset of treatment. His return to duty status is doubtful.

The load of pack carrying, engrafted on a previously partially denervated shoulder girdle musculature, may mimic true "pack palsy" and incapacitate the soldier for military duty.

CASE 3. H. Y., sergeant, was admitted to the Ashford General Hospital on 10 April because of pain and weakness in the left shoulder. At the age of four, an abscess in the left superior cervical triangle had been incised and drained. As long as he could recall, his left shoulder had been weaker than the right. When he wore tight sweaters, his brother would tell him that his left shoulder blade protruded more than the right. He had worked, played games including football, and had not been handicapped by motor disability until he entered the Army, although he could not abduct the left arm above 90 degrees. On carrying heavy packs or armament, his disability was exaggerated. He developed aching pain in the entire shoulder and in the upper chest walls. His increasing inability to carry heavy weight forced his return to the zone of the interior from combat duty. Although the pain decreased, there had been no relief from muscle dysfunction since his return to a sedentary type of duty.

The patient was tall, lean, and heavily muscled, with an old operative scar, 5 cm. in length, anterior to the upper third of the left sternocleidomastoid muscle. Moderate atrophy of the left sternocleidomastoid muscle with weakness of rotation of the head to the right was present. The clavicular portion of the trapezius muscle was atrophic and the muscle loss was replaced by a band of firm, fibrous tissue. The mesial border of the scapula flared and was displaced outward. Abduction of the arm was not possible above 90 degrees nor could the arm be fully extended in the forward plane of the body. Counterpressure on the extended arm caused some flaring of the tip of the scapula. Hypalgesia and hypesthesia were present over the dermatomes of C3, C4, and C5, and in these areas the patient complained of burning intermittent pain. The history and neurologic examination suggested incomplete involvement of the spinal-accessory nerve and sensory components of the third, fourth, and fifth cervical nerves by operative trauma at an early age, followed by accentuation and spread of the neural dysfunction through the direct trauma of pack- and armament-carrying. His present condition is unchanged.

DISCUSSION

These three instances of pack palsy indicate that trauma from carrying heavy packs or armament may involve, not only the long thoracic nerve, but the accessory nerve as well. The exposed, practically subcutaneous position of this nerve, as it passes from the posterior border of the sternocleidomastoid muscle beneath the anterior edge of the trapezius, makes it susceptible to this type of trauma. The anastomosis of the proximal part of a divided spinal accessory nerve to the distal end of a paralyzed facial nerve is a well-accepted neurosurgical procedure. The resultant dysfunction may be variable and has not

been recognized as disabling in civilian pursuits. Obviously the disabilities described are not compatible with full military duty. In each instance, whether or not other neural dysfunction was present, the disqualifying disability presented itself as a failure in abduction above 90 degrees, due to paralysis of the middle and lower thirds of the trapezius muscle. In an incomplete, bilateral lesion of the spinal accessory nerve noted late after removal of tuberculous glands from the neck,³ the resulting dysfunction was similar to that exhibited in case 1. No other report of bilateral loss or diminution of function of the external branches of the spinal accessory nerve is available. Case 2 is a classical instance of unilateral pack palsy with involvement of the accessory nerve, although the incidental subclavian ligation has colored the subjective reaction of the patient. Division of the accessory nerve in the course of operation procedures in the neck occurs commonly and, in case 3, the addition of heavy pack-carrying overburdened an already weakened shoulder girdle.

An opportunity to study a case of pack palsy at its inception has not been available. In Ilfeld's and Holder's case prompt recognition of the pressure palsy and early treatment of the disorder resulted in subsidence of all evidence of neural dysfunction in four weeks. It seems apparent that early recognition and prevention of the continuing trauma to the involved neural structures form sufficient means of treatment. If the inciting trauma is allowed to persist, the resulting muscle atrophy and loss of function may be prolonged indefinitely. Although the pathology of this specific type of compression neuritis is not known, similar compression neuritides have exhibited well-marked changes indicative of secondary degeneration in the distal segment depending on the extent and duration of the trauma. In case 3, in which the inciting trauma persisted for six months, definitive treatment included mechanical support of the affected musculature, radiant heat, massage, galvanism, and an adequate vitamin intake. Local exploration of the nerve is not indicated, nor do orthopedic fixation procedures appear feasible.

3. Bruce, A. W.: Paralysis of the Spinal Accessory Nerve Following Many Years After the Removal of Tuberculous Glands from the Neck, *Rev. Neurol. and Psychiat.*, Edinburgh, 13:51-57, 1915.

Medical Museum Seminar.—The weekly seminar at the Army Medical Museum, Washington, D. C., 21 October, was addressed by Dr. Enrique Koppisch, professor of pathology, School of Tropical Medicine, Columbia University, on "The Pathology of Sprue."

Isolated Outbreaks of Streptococcal Sore Throat

CAPTAIN OWEN S. OGDEN

Medical Corps, Army of the United States

Four separate and distinct outbreaks of acute follicular tonsillitis occurred during the year ending with June 1944 at Fort Francis E. Warren, Wyoming. During the preceding two years, scarlet fever had been prevalent on this post. During the year reported, only a few isolated cases of scarlet fever developed.

The first outbreak occurred on 22 June 1943, when forty cases of acute follicular tonsillitis reported to sick call from four barracks in one company of a regiment. Eighty-three percent of these men were found to have throat cultures positive for beta hemolytic streptococcus and, clinically, all in this group had temperatures ranging from 99° to 104° and showed a shaggy, white follicular exudate of the tonsils. All of these cases were isolated on the second floor of one barracks and fed separately from the rest of the company. They were treated as quarters cases. The treatment consisted of bed rest, forced fluids, aspirin, and 1½ grains of sulfanilamide every four hours in the form of troches. Fifty-five percent of these men were able to return to duty with throats entirely clear in three days, and another 25 percent in four days.

As contacts, four men working in the kitchen were found to have throats positive for beta hemolytic streptococcus, without symptoms; two of these men were permanent cooks and the other two were temporary kitchen police. The dishwashing in this mess was found to be faulty in that a spray was used instead of the final rinse, which gave insufficient hot water to properly sterilize the dishes. One week before the outbreak, two cases of scarlet fever were hospitalized from this company and two cases were hospitalized on 27 June, six days following the outbreak.

On 14 June 1943, the second outbreak occurred in another company of the same regiment. Forty cases of acute follicular tonsillitis reported to the dispensary the first day, and two days later eight additional cases reported. These men were housed in four barracks. Ten cultures taken at random in this group were positive for beta hemolytic streptococcus. Cultures of the mess personnel were negative. At the time of this outbreak, the entire company were eating from mess kits. Cultures of a number of these kits failed to reveal causative organ-

isms. Treatment was the same as in the first outbreak. About 12.5 percent of these men were able to return to duty in two days with clear throats and another 57.5 percent returned to duty on the third day. There were no known contacts of scarlet fever or other streptococcal diseases among these men, nor were there any return cases after the outbreak.

In still another company of the same regiment, eight patients reported to sick call on 26 July 1943 with symptoms the same as those reported in the outbreaks above. Cultures were not taken of these cases. Sanitation throughout the company was satisfactory. These eight men were housed on the second floor of a barracks, from which about ten days previously two patients had been admitted to the hospital with scarlet fever. One of these patients with scarlet fever was returned to the barracks on 21 July, just five days before the outbreak. The day after his return, he was found to have an acute cervical adenitis and his throat culture was positive for beta hemolytic streptococcus. All eight men were bedded close to this one patient with active secondary complications of scarlet fever.

On 23 February 1944, on a clean urological ward of the station hospital, 18 patients were found to have throat cultures positive for beta hemolytic streptococcus. There was a total of 33 patients on this ward, 27 Negro and 6 white. Fifty-four percent of the patients of this ward showed positive throat cultures for beta hemolytic streptococcus. Twelve days before this outbreak, a case of tonsillitis was reported in one patient on the ward and he was immediately isolated. On 24 February on a respiratory ward, 22 patients were found to have positive throat cultures for beta hemolytic streptococcus. All ward and kitchen help were cultured and found to be negative for beta hemolytic streptococcus. In the urological ward it is logical to assume that the one case of acute tonsillitis was the etiologic agent for the outbreak; whereas in the respiratory ward, it is hardly necessary to look for a definite carrier. All positive cultures were positive for beta hemolytic streptococcus. Facilities for streptococcus typing were not available at the time of the first three outbreaks. Cultures from the last outbreak were sent to the Air-Borne Infections Commission for typing but the specimens did not arrive in a condition good enough for satisfactory typing.

Treatment consisted of a single large dose of 4 grams of sulfathiazole in one ward and repeated smaller doses of 1 gram every four hours in the other. The repeated smaller doses were much more effective than the larger doses.

A follow-up was conducted on all personnel in the above outbreaks, and up to the present time there have been no admissions to the hospital from this group for any complications of streptococcal diseases or for rheumatic fever.

MALARIA APPEARING AFTER DISCONTINUANCE
OF ATABRINE PROPHYLAXISMAJOR ROBERT L. CAVENAUGH
Medical Corps, United States Army

This is a report of a case of malaria which first developed in a soldier six and one-half months after he had discontinued suppressive treatment for malaria.

A corporal, white, aged 29, born in Michigan, was inducted into the Army in Montana in March 1942. He had never had malaria. After training in southern California and central Texas he sailed, in August 1942, for Great Britain; after several months, he landed in North Africa on 1 February 1943. For five and one-half months in French Algeria he took atabrine under careful supervision, 0.1 gm. with the evening meal, four days a week. Throughout this period, he stated, not more than three doses were omitted. He sailed for the United States on a duty status on 15 July 1943.

Three weeks prior to departure for the United States the patient believed that he was exposed to malaria during three days at a rest camp near the Mediterranean coast where mosquitoes were numerous. Subsequently, while his unit was at its own bivouac area, 2 to 6 July, two of his associates were hospitalized with malaria. These had been truck drivers and had presumably missed taking atabrine because of irregular meals. The corporal, however, carefully continued atabrine prophylaxis up to the sailing date, 15 July, when it was discontinued. He remained asymptomatic.

While in the United States the latter half of 1943 he resided in non-malarious regions. On 28 January 1944, about two weeks after sailing again for overseas duty, he suddenly developed a shaking chill and fever, which on admission to sick bay was 105.2° F. He was sallow, and the spleen was about twice normal size and tender. The next day the temperature was normal. Again on 30 January and on 1 February his temperature was high, although normal on the intervening days. After the second chill, a trace of albumin and a few granular casts were found in the urine. Diligent search of thick and thin films of his blood finally resulted, on 1 February, after the third chill, in a diagnosis of *Plasmodium vivax* infection. Small numbers of schizonts and a few gametocytes were identified. Treatment was instituted at once.

It is unusual to find the first appearance of malaria in a soldier from the northern part of the United States, while en route to duty overseas. Infection had doubtless occurred over six months previously, while the patient was on foreign duty, but development of the infection was deferred, presumably because of the atabrine prophylaxis. The delay of four days in the establishment of the diagnosis in this case might well have been serious, even fatal, had the infection been caused by *Plasmodium falciparum*. This report may therefore serve as a warning that malaria must be constantly suspected among all members of the armed services who have lived in malarious regions, regardless of their apparent freedom from infection, their recent residence in cold climates, or the absence of symptoms over prolonged periods after exposure to malaria infection.

AMELOBLASTOMA OF THE MANDIBLE

Report of Case

FIRST LIEUT. HENRY M. GOLDMAN
Dental Corps, Army of the United States

A soldier, white, aged 29, reported to the dental clinic because of a painless swelling of the left mandible. Four months previously, before induction, a mandibular impacted premolar, the site of which was badly inflamed, had been removed.

A tumor was found attached to the left mandible, extending from the region of the mental foramen to the angle of the jaw. The growth was firm except for an area anterior to the angle of the mandible where some fluctuation was noted. Radiographic examination showed a multicystic area about 5 by 4 cm. in greater diameters, divided into sections by bony septa. Enlargement of the body of the mandible from the canine to the third molar region was present. There was apparent destruction of the buccal plate with the mass extending below its normal inferior border. A diagnosis of ameloblastoma was made on the basis of the clinical and radiographic findings. The extent of the tumor necessitated resection of the mandible.

At operation at the Borden General Hospital, an incision was made below the inferior border of the mandible extending from the lobe of the ear posteriorly to the median line of the neck. Skin, subcutaneous tissue, and muscle were undermined and a flap formed, which was retracted across the cheek. The fascial vessels were ligated, the mandible was exposed, and the periosteum was elevated. The muscles were then separated from the inferior portion of the mandible. The anterior portion of the mandible was cut through just to the right of the median line and also 1 cm. above the angle of the mandible posteriorly. The muscle attachments on the inner border of the mandible were separated and the bone, including a large mass of tissue, was removed. The tumor also extended into the neck and had to be separated by blunt dissection from the muscles.

The gross specimen consisted of a portion of the body and the ramus of the left mandible, to which was attached a growth 6 by 4 by 5.3 cm. which also invaded the bone (figure 1). The larger part of the tumor was on the buccal side of the bone,

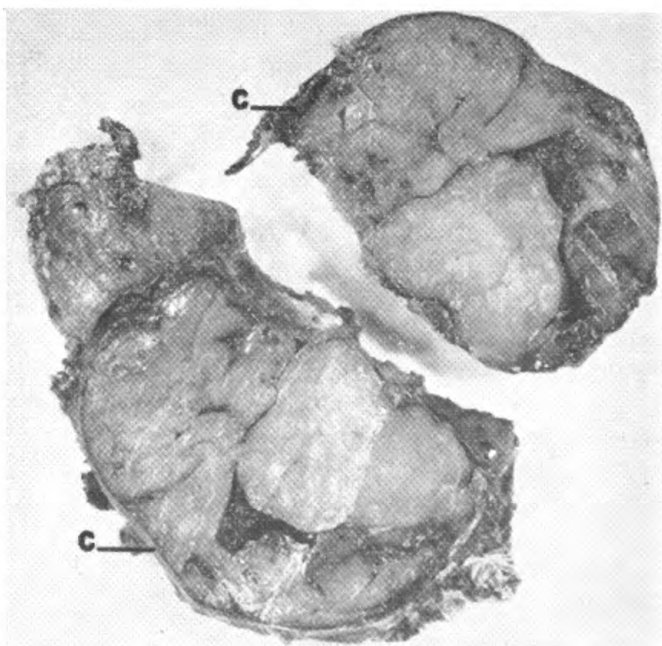


FIGURE 1. (Army Medical Museum negative No. 78694)

From the Army Institute of Pathology, Army Medical Museum, Washington, D. C.

the lower border of the mandible being completely eroded and replaced by neoplastic tissue. The tumor appeared bluish and was covered by a thick fibrous capsule in which were occasional hemorrhages (figure 1, C). The growth cut with relative ease and, on section, appeared compact, dull white, and interspersed with numerous fine trabeculae.

Microscopic Examination

Microscopic examination showed the tumor to be composed of large columns and strands of epithelial cells embedded in a fibrous matrix (figure 2). The epithelial strands for the most part were thin and multibranching and wound through many microscopic fields. Some appeared like tooth buds, others were in the bell shape of the pre-enamel organ. In the individual strand the outermost layer of cells was columnar (figure 2, A) while the center consisted either of squamous cells (figure 2, C) or of smaller cells with clear cytoplasm, giving the tissue a reticulated appearance. The

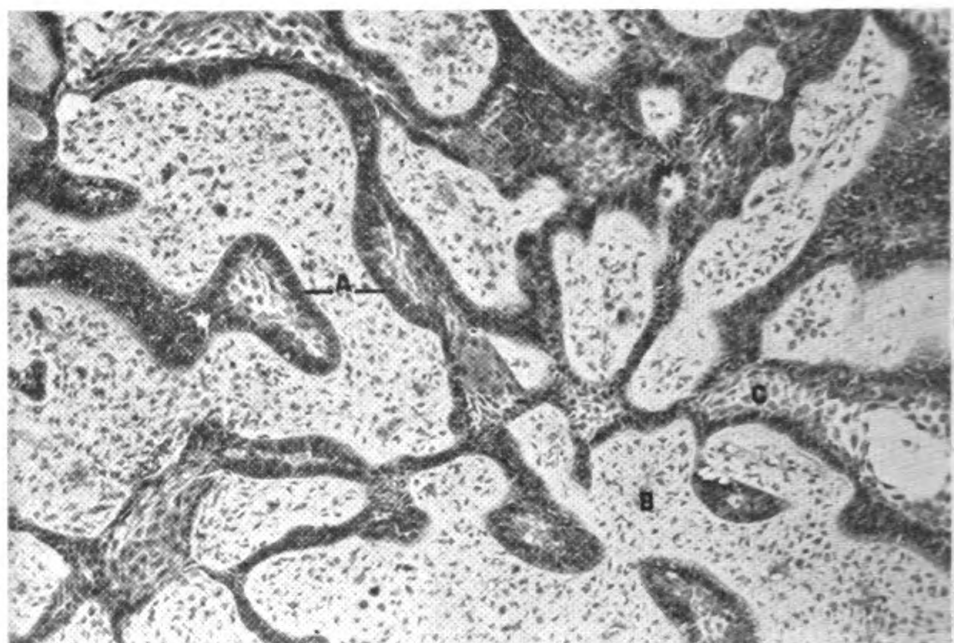


FIGURE 2. (Army Medical Museum negative No. 81588) 175X.

supporting stroma (figure 2, B) for the most part was simple fibrous connective tissue but, in many areas, the fibrous tissue cells were irregularly disposed, their cytoplasm edematous and the nuclei large with prominent nucleoli. Among them were numerous multinucleated cells. The stroma presented the appearance of tissue seen in the dental papilla of tooth formation. The microscopic examination confirmed the clinical diagnosis of ameloblastoma.

This case has especial interest because of the great extent of the tumor and the unusual microscopic findings. Although in the radiograph the lesion appeared multicystic, actually it was solid and contained both the epithelial and connective tissue elements of the tooth germ, the former resembling the early enamel organ, the latter displaying the features of the dental papilla; therefore, this tumor may also be regarded as an odontogenic mixed tumor.

Index

	<i>Page</i>
Acrylic Mouth Prop, Adjustable	77
Ameloblastoma of the Mandible	121
Army Medical Library, Program to Improve the	19
Athletic Contests and the Greek Nation	76
Award of Soldier's Medal	38
Blood, Whole, Daily Shipments of, to Europe	2
Cerebral Cortex, Injury to, Following Anoxemia and Exsanguination	104
Dental Service on an Army Transport	36
Dental Society, Chicago	32
Directives and Publications, Recent	37
Discharges, Disability	52
Educational Program for Convalescent Hospitals	10
Evacuation of Casualties, Air	21
Evacuation, The Normal Chain of	11
Eye, Infected Chemical Burns of the	8
Field Hospitals, Surgery at	22
Food in the Burma Jungles	34
Footdrop Following Skeletal Fixation	73
Fractures, Fixation of, with Metal	3
Gold Alloy Treatment, Wrought	15
Homografts in Man, Failure of Whole Fresh	9
Latrine, The Mound	15
Malaria Appearing After Discontinuance of Atabrine Prophylaxis	120
Malaria, The Cerebral Form of	39
Medical Meeting, Monthly	13
Mononucleosis, Infectious	80
Museum Seminar, Medical	117
Neuropsychiatric Outpatient Department	100
Nurses, Shortage of	26
Nutrition, Consultants in	34
Ophthalmia, Sympathetic	49
Pack Palsy	112
Photoroentgen Camera Tube Coupling Device	32
Plant Collecting by the Armed Services	55
Plasma Unit, Uses for the Army-Navy	29
Pneumonia, Primary Atypical, Complications of	67
Procaine Cartridges	13
Psychologists, Commissions for	20
Respiratory Diseases, Sulfadiazine in the Prevention of	5
Sanitation in the Field	14
Scrub Typhus, The Prevention of	1
Smallpox in Civilians at an Air Field	27
Streptococcal Sore Throat, Isolated Outbreaks of	118
Supplies, Medical, for Liberated and Occupied Territories	27
Trench Foot	58
Urethra, Membranous, Repair of Rupture of	18
Venereal Disease Rates Overseas	16
Washing Machine	35
Water Supplies, Field, in Tunisia	94
Wounds of the Extremities	79

